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Final Best Demonstrated Available Technology (BDAT) Background Document for Characteristic Ignitable Wastes (D001) Characteristic Corrosive Wastes (D002) Characteristic Reactive Wastes (D003), and P and U Wastes Containing Reactive Listing Constituents. Volume 2

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This background document presents the Agency's technical support for slecting and developing the treatment standards for D001, D002, D003, and P and U wastes containing reactive listing constituents. Section 1 presents waste-specific information; Section 2 describes the industries that will be affected by the land disposal restrictions for the specific characteristic waste; Section 3 discuses applicable technologies that can be used to treat the waste; and Section 4 identifies the BDAT.

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1. INTRODUCTION AND SUMMARY

The Hazardous and Solid Waste Amendments (HSWA), enacted on November 8, 1984, amended the Resource Conservation and Recovery Act (RCRA) of 1976. Pursuant to HSWA, section 3004(g) of RCRA requires the U.S. Environmental Protection Agency (EPA) to promulgate regulations that restrict the land disposal of hazardous wastes beyond specified dates. Under section 3004(m) of RCRA, the Agency is required to set "levels or methods of treatment, if any, which substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized." As specified in the promulgated regulatory framework for implementing the land disposal restrictions, these "treatment standards" are based on the performance of the best demonstrated available technology (BDAT) for a waste.

Consistent with section 3004(m) of RCRA, EPA is promulgating treatment standards based on the best demonstrated available technology (BDAT) for characteristic ignitable wastes (D001), characteristic corrosive wastes (D002), characteristic reactive wastes (D003), and P and U wastes containing reactive listing constituents. Compliance with these BDAT treatment standards is a prerequisite for the placement of these wastes in units designated as land disposal facilities.

Wastes that are hazardous because they exhibit a hazardous characteristic are no longer considered hazardous if they are treated so that they no longer exhibit any of the characteristics. It is important to note out that treatment of any ignitable, corrosive, or reactive wastes must remove all of the hazardous characteristics of the waste. For example, ash residues from the incineration of an ignitable waste will no longer be ignitable, but may exhibit the characteristic of EP toxicity for metals (because the metals concentrate in the ash) even though the waste may not have been EP toxic prior to incineration; this residue may therefore require further treatment. Note that if the characteristic waste or the residual is mixed with a listed hazardous waste, it is considered to be the listed hazardous waste even if treated to remove all characteristics, and it must meet any standards set for the listed hazardous waste.

EPA may establish treatment standards either as a specific treatment technology or as a performance level of treatment monitored by measuring the concentration levels of the hazardous constituents in the waste, treatment residual, or extract of the waste. EPA prefers to establish treatment standards as performance levels; however, because of the diversity of constituents present in wastes that can be classified as D001, D002, and D003, the Agency has been unable to identify a list of constituents that could be used to regulate these wastes. In addition, there are no EPA-approved analytical methods for measuring most of the P and U reactive listing constituents. Therefore, EPA is promulgating treatment technologies as BDAT treatment standards for D001, D002, and some subcategories of D003 and P and U wastes containing reactive listing constituents. For the D003 Reactive Cyanide Subcategory, EPA is promulgating performance level treatment standards for cyanide in wastewaters and nonwastewaters, since waste characterization data show that this BDAT list constituent is consistently present at treatable concentrations in the waste and treatment performance data and analytical methods are available for this constituent. For P056 (fluorine) and U134 (hydrogen fluoride) wastewaters, EPA is promulgating performance level treatment standards for fluoride. EPA is also promulgating performance level treatment standards for nickel in P073 (nickel carbonyl) wastewaters and nonwastewaters based on treatment performance data applicable to these wastes.

For D003, EPA has concluded that there are five subcategories: the Reactive Cyanides Subcategory, the Reactive Sulfides Subcategory, the Explosives Subcategory, the Water Reactives Subcategory, and the Other Reactives Subcategory. Table 1-3 presents treatment standards for the five D003 subcategories.

The Agency has determined that wastes with reactive P and U listing constituents can be divided into four subcategories: Incinerable Reactive Organic and Hydrazine Derivatives, Incinerable Inorganics, Fluorine Compounds, and Recoverable Metallics. A listing of all reactive P and U waste codes is provided in Section 5. Shown in Table 1-4 are the treatment standards for the P and U wastes containing reactive listing constituents.

This background document presents the Agency's technical support for selecting and developing the treatment standards for D001, D002, D003, and P and U wastes containing reactive listing constituents. It is organized into five chapters, and each chapter is arranged in four sections. Section 1 of each chapter presents waste-specific information such as the waste-generating processes and waste characterization. The industries that will be affected by the land disposal restrictions for the specific characteristic waste are described in Section 2. The applicable technologies that can be used to treat the waste are discussed in Section 3. Section 4 identifies the best demonstrated available technology.

The BDAT program and EPA's promulgated methodology are more thoroughly described in two additional documents: Methodology for Developing BDAT Treatment Standards (USEPA 1988a) and Generic Quality Assurance Project Plan for Land Disposal Restrictions Programs (BDAT) (USEPA 1987a). The petition process to be followed in requesting a variance from the BDAT treatment standards is discussed in the methodology document.

Because of the nature of the subcategories of these wastes, the Agency is not distinguishing wastewater versus nonwastewater standards in all cases. Sometimes this is because there is no way to physically distinguish one from the other (e.g., D001 compressed gases are neither wastewaters nor nonwastewaters), or sometimes it is prudent to apply the same technology to both wastewaters and nonwastewaters. In other cases, only nonwastewater or only wastewater standards are being promulgated for subcategories of these characteristic wastes. For the purpose of determining the applicability of the treatment standards, wastewaters are defined as wastes containing less than 1 percent (weight basis) total suspended solids* and less than 1 percent (weight basis) total organic carbon (TOC). Wastes not meeting this definition must comply with the treatment standards for nonwastewaters.

EPA has determined that wastes defined as D001 represent four major subcategories based on chemical and physical composition: the Ignitable Liquids Subcategory, the Ignitable Compressed Gases Subcategory, the Ignitable Reactives Subcategory, and the Oxidizers Subcategory. The Ignitable Liquids Subcategory has been further subcategorized into three treatability groups: (1) D001 Ignitable Liquids High TOC Nonwastewaters; (2) D001 Ignitable Liquids Low TOC Nonwastewaters; and (3) D001 Ignitable Liquids Wastewaters. Treatment standards for all D001 wastes are presented in Table 1-1 at the end of this section.

The Agency has determined that D002 wastes may belong to an Acid Subcategory, an Alkaline Subcategory, or an Other Corrosives Subcategory. Treatment standards for the D002 subcategories are shown in Table 1-2.

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* The term "total suspended solids" (TSS) clarified EPA's previously used terminology of "total solids" and "filterable solids." Specifically, the quantity of total suspended solids is measured by Method 209c (Total Suspended Solids Dried at 103 to 105°C) in Standard Methods for the Examination of Water and Wastewater, 16th Edition (APHA, AWWA, and WPCF 1985).

Table 1-1 BDAT Treatment Standards for D001

IGNITABLE LIQUIDS SUBCATEGORY 261.21(a)(1) [Nonwastewaters] (High TOC Ignitable Liquids Subcategory - Greater than or equal to 10% total organic carbon)
INCINERATION (INCIN), FUEL SUBSTITUTION (FSUBS), OR RECOVERY (RORGS) AS METHODS OF TREATMENT*
IGNITABLE LIQUIDS SUBCATEGORY 261.21(a)(1) [Nonwastewaters] (Low TOC Ignitable Liquids Subcategory - Less than 10% total organic carbon)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*
IGNITABLE LIQUIDS SUBCATEGORY 261.21(a)(1) [Wastewaters]
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*
IGNITABLE COMPRESSED GASES SUBCATEGORY** 261.21(a)(3)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*

---

* Incinerators must comply with 40 CFR 264 Subpart 0 or 265 Subpart 0. Fuel substitution units must be in compliance with 40 CFR Part 266 Subpart D. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in a combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

** Ignitable gases may be vented directly into an incinerator or reactor or vented into a suitable adsorbent prior to treatment. Although the gases, once vented, are no longer compressed in a cylinder, the Agency does not consider that treatment has occurred until the ignitable gas has been incinerated or otherwise treated. Adsorption of the ignitable gas into either a solid or liquid adsorbent is typically a reversible physical process. Thus, the ignitable chemical has not been destroyed.

Table 1-1 (continued)

IGNITABLE REACTIVES SUBCATEGORY 261.21(a)(2) [Nonwastewaters]
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*
OXIDIZERS SUBCATEGORY 261.21(a)(4) [Nonwastewaters and wastewaters]
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY**

* Incinerators must comply with 40 CFR, 264 Subpart 0 or 265 Subpart 0. Fuel substitution units must be in compliance with 40 CFR Part 266 Subpart D. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in a combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

** Ignitable gases may be vented directly into an incinerator or reactor or vented into a suitable adsorbent prior to treatment. Although the gases, once vented, are no longer compressed in a cylinder, the Agency does not consider that treatment has occurred until the ignitable gas has been incinerated or otherwise treated. Adsorption of the ignitable gas into either a solid or liquid adsorbent is typically a reversible physical process. Thus, the ignitable chemical has not been destroyed.

Table 1-2 BDAT Treatment Standards for D002

ACID SUBCATEGORY 261.22(a)(1)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF CORROSIVITY*
ALKALINE SUBCATEGORY 261.22(a)(1)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF CORROSIVITY*
OTHER CORROSIVES SUBCATETORY 261.22(a)2
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF CORROSIVITY*

*** See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.**

Table 1-3 BDAT Treatment Standards for D003

REACTIVE CYANIDES SUBCATEGORY
261.23(a)(5)
[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/kg)
Cyanides (Total)	590
Cyanides (Amenable)	30

REACTIVE CYANIDES SUBCATEGORY
261.23(a)(5)
[Wastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/l)
Cyanides (Total)	Reserved
Cyanides (Amenable)	0.86

Table 1-3 (continued)

REACTIVE SULFIDES SUBCATEGORY 261.23(a)(5)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

EXPLOSIVES SUBCATEGORY 261.23(a)(6)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

WATER REACTIVES SUBCATEGORY 261.23(a)(2)(3), AND (4)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

OTHER REACTIVES SUBCATEGORY 261.23(a)(1)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

---

* See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

TABLE 1-4 BDAT Treatment Standards for P and U Wastes Containing Reactive Listing Constituents

BDAT TREATMENT STANDARDS FOR P009, P068, P081, P105, P112, U023, U086, U096, U098, U099, U103, U109, U133, AND U160
[Nonwastewaters]

INCINERATION (INCIN), FUEL SUBSTITUTION (FSUBS),
CHEMICAL OXIDATION (CHOXD), OR
CHEMICAL REDUCTION (CHRED)
AS METHODS OF TREATMENT*

BDAT TREATMENT STANDARDS FOR P009, P068, P081, P112, U023, U086, U096, U098, U099, U103, U109, U133, AND U160
[Wastewaters]

INCINERATION (INCIN), CHEMICAL OXIDATION (CHOXD),
CHEMICAL REDUCTION (CHRED), CARBON ADSORPTION (CARBN), OR
BIODEGRADATION (BIODG) AS METHODS OF TREATMENT*

BDAT TREATMENT STANDARDS FOR P006, P096, P122, U135, and U249
[Nonwastewaters and Wastewaters]

INCINERATION (INCIN), CHEMICAL OXIDATION (CHOXD), OR
CHEMICAL REDUCTION (CHRED) AS METHODS OF TREATMENT*

---

* Incinerators must comply with 40 CFR 264 Subpart O or 265 Subpart O. Fuel substitution units must comply with 40 CFR Part 266 Subpart D. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

Table 1-4 (continued)

BDAT TREATMENT STANDARDS FOR P056
[Nonwastewaters]

ADSORPTION (ADGAS) FOLLOWED BY NEUTRALIZATION (NEUTR)
AS A METHOD OF TREATMENT*

BDAT TREATMENT STANDARDS FOR U134
[Nonwastewaters]

NEUTRALIZATION (NEUTR) OR ADSORPTION (ADGAS) FOLLOWED
BY NEUTRALIZATION (NEUTR)
AS METHODS OF TREATMENT*

BDAT TREATMENT STANDARDS FOR
P056 AND U134
[Wastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/l)
Fluoride	35

BDAT TREATMENT STANDARDS FOR
P015 AND P087
[Nonwastewaters and Wastewaters]

RECOVERY (RMETL OR RTHRM) AS A METHOD OF TREATMENT*

---

* See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

Table 1-4 (continued)

BDAT TREATMENT STANDARDS FOR P073
[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/kg)
Nickel	0.32

BDAT STANDARDS FOR P073
[Wastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/l)
Nickel	0.44

2. CHARACTERISTIC IGNITABLE WASTES (D001)

According to 40 CFR 261.21, there are four criteria for defining a waste as a D001 Ignitable Waste. Paraphrasing these criteria, a waste can be a D001 waste if (1) it is a liquid with a flash point less than 140°F; (2) it is an ignitable compressed gas; (3) it is not a liquid and is capable of causing fire through friction, absorption of moisture, or spontaneous chemical changes and, when ignited, burns vigorously and persistently; or (4) it is an oxidizer.

Although some D001 wastes may exhibit characteristics of more than one criterion, EPA determined that these four criteria translate directly into four subcategories for D001 wastes. The first subcategory is classified as the Ignitable Liquids Subcategory, the second subcategory is classified as the Ignitable Compressed Gases Subcategory, and the third subcategory is classified as the Ignitable Reactives Subcategory. The fourth subcategory is classified as the Oxidizers Subcategory.

2.1 Waste Characterization

Because of the variety of wastes classified as D001, it is not possible to characterize every individual D001 waste stream. Therefore, the Agency based its BDAT development for D001 wastes on a generalization of waste characterization for each subcategory listed above. Tables A-1 and A-2 in Appendix A present some waste characterization for the RCRA-permitted facilities that generated D001 wastes and D001 wastes mixed with other RCRA-listed and characteristic wastes, respectively. This information has been gathered from the 1986 National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (TSDR Survey); confidential business information is not included.

2.1.1 Ignitable Liquids Subcategory

These wastes are liquids that at a temperature of 140°F or less, referred to as the flash point, give off a vapor sufficient to form an ignitable mixture with the air near the surface of the liquid or containment vessel. For the purposes of the official DOT shipping regulations, the flash point is determined by the Tagliabue open-cup method (ASTM D1310-63).

The majority of all D001 wastes generated can be identified as ignitable liquids. Most of these ignitable liquid wastes are primarily organic liquids. The major organic constituents in these wastes are volatile, flammable hydrocarbons or oxygenated hydrocarbons that provide the characteristics of ignitability to the waste (i.e., a flash point of less than 140°F). These constituents may also be potential carcinogens or otherwise toxic. Some D001 ignitable liquids have been shown to contain organic constituents that are also constituents in F001-F005 waste solvents. These constituents include the following:

Acetone
n-Butyl alcohol
Carbon disulfide
Carbon tetrachloride
Chlorinated fluorocarbons
Chlorobenzene
Cresols
Cresylic acid
Cyclohexanone
1,2-Dichlorobenzene
Ethyl acetate
Ethyl ether
Ethylbenzene
Isobutanol
Methanol
Methyl ethyl ketone
Methyl isobutyl ketone
Methylene chloride
Nitrobenzene
Pyridine
Tetrachloroethylene
Toluene
Trichloroethylene
1,1,1-Trichloroethane
1,1,2-Trichloro-1,2,2-trifluoroethane
Trichlorofluoromethane
Xylene

Other wastes in the subcategory may contain unlisted solvents, paint thinners, degreasing compounds, byproduct liquids, contaminated oils, petroleum distillates, lacquers, varnishes, and contaminated fuels.

Additionally, available waste characterization data and additional information received indicate that some D001 ignitable waste streams can have a relatively low organic content (less than 10 percent) and a high water content. The waste characterization data for wastes in the Ignitable Liquids Subcategory are shown on Table A-3 in Appendix A. Based on characterization information, treatment technology capabilities corresponding to the organic and water contents of wastes, and the Agency's regulatory definitions of wastewaters and nonwastewaters, EPA determined that the Ignitable Liquids Subcategory should be further subcategorized by division into three treatability groups as follows: (1) D001 Ignitable Liquids High TOC Nonwastewaters, (2) D001 Ignitable Liquids Low TOC Nonwastewaters, and (3) D001 Ignitable Liquids Wastewaters. Division of this subcategory into the three treatability groups is discussed in more detail in later sections.

The D001 Ignitable Liquids High TOC Nonwastewaters Subcategory is defined as ignitable liquid wastes that contain greater than or equal to 10 percent TOC as generated. These wastes will have large organic concentrations, high BTU contents, and low water contents. The D001 Ignitable Liquids Low TOC Nonwastewaters Subcategory is defined as wastes that contain greater than 1 percent but less than 10 percent TOC as generated. The Ignitable Liquids Wastewaters Subcategory is defined as wastes that contain less than 1 percent TOC and less than 1 percent TSS as generated (the BDAT definition of a wastewater). Because of their relatively low organic concentrations and high water contents, wastes in these subcategories generally will not have high BTU contents.

To identify wastes in the Ignitable Liquids Wastewaters Subcategory, (i.e., a waste with less than 1 percent TOC, less than 1 percent TSS, and a flash point lower than 140°F), the Agency had flash point analyses performed on eight organic aqueous mixtures meeting the BDAT definition of a wastewater. Several of the aqueous mixtures had a flash point lower than 140°F. However, after flashing, combustion was not sustained. The issue of sustained combustion is not relevant at this time because the length of time over which combustion is sustained at a temperature of lower than 140°F is not specified as part of the D001 definition. The Agency believes that such a regulatory change may be appropriate in the future. Although EPA could not determine whether wastewaters in the ignitable liquids subcategory exist, several facilities claim these wastes are generated; consequently, the Agency believes that establishing an Ignitable Liquids Wastewaters Subcategory is appropriate. A summary of the flash point analyses performed for EPA is included as Appendix B.

2.1.2 Ignitable Compressed Gases Subcategory

D001 wastes in the Ignitable Compressed Gases Subcategory are those wastes that meet the definition of an ignitable compressed gas according to 49 CFR 173.300. By definition, the term "ignitable compressed gas" designates (1) any material or mixture having in the container an absolute pressure exceeding 40 psi at 70°F or, regardless of the pressure at 70°F, having an absolute pressure exceeding 104 psi at 130°F or (2) any liquid flammable material having a vapor pressure exceeding 40 psi at 100°F as determined by ASTM Test D-323. For each of the above cases, any one of the following must also occur:

1. Either a mixture of 13 percent or less (by volume) with air forms a flammable mixture or the flammable range with air is wider than 12 percent, regardless of the lower limit. These limits should be determined at atmospheric temperature and pressure. The method of sampling and test procedures must be acceptable to the Bureau of Explosives and approved by the Director, OHMT.
2. Using the Bureau of Explosives' Flame Projection Apparatus,* the flame projects more than 18 inches beyond the ignition source with valve opened fully, or the flame flashes back and burns at the valve with any degree of valve opening.

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* A description of the Bureau of Explosives' Flame Projection Apparatus, Open Drum Apparatus, Closed Drum Apparatus, and method tests can be obtained from the Bureau of Explosives.

3. Using the Bureau of Explosives' Open Drum Apparatus, there is any significant propagation of flame away from the ignition source.

4. Using the Bureau of Explosives' Closed Drum Apparatus, there is any explosion of the vapor-air mixture in the drum.

The physical characteristics of wastes in this subcategory are generally discarded cylinders containing a compressed gas. The Agency believes that generators of byproduct gaseous wastes generated during a process generally flare these gases to destroy them and do not place the waste gases in containers. Therefore, the majority of these waste containers will probably be empty containers containing gas residues of the containerized gases that were used in a process, rather than gaseous wastes generated during a process. Containerized gases that might be used in a process and disposed of in a container would include acetone, oxygen, methane, hydrogen, propane, butane, and acetylene. Pyrophoric gases are also included in this subcategory. Typical pyrophoric gases include tributyl aluminum, dimethylzine, triethylborane, and tetramethylin.

2.1.3 Ignitable Reactives Subcategory

By definition in 40 CFR 261, these nonliquid wastes are capable of causing fire through friction, absorption of moisture, or spontaneous chemical change. Furthermore, when these wastes are ignited, they burn vigorously and persistently. Based on these physical waste descriptions, there appears to be an overlap of this D001 subcategory with certain D003 reactive wastes. However, a close examination of the definitions in 261.21(a)(2) for ignitable wastes and 261.23(a)(2), (3), and (6) for reactive wastes reveals the distinction. The key difference is found in the phrase for ignitable wastes "...when ignited, burns vigorously and persistently." This phrase implies that the hazard is due primarily to the ignition potential rather than to the extreme reactivity.

D001 Ignitable Reactives are generated on a sporadic basis and generally in low volumes. These wastes are primarily inorganic nonwastewaters or other wastes containing reactive materials. Ignitable reactives include materials such as reactive alkali metals or metaloids (such as sodium and potassium) and carbide slags. These wastes are very reactive with water and can ignite because of the generation of gases and heat from the reaction with water. Other ignitable solids in this subcategory include metals such as magnesium and aluminum that, when finely divided, can vigorously react with oxygen in the air if they are ignited under certain conditions. Zirconium fines that are pyrophoric (i.e., that cause fire through friction) have also been included in this D001 subcategory.

2.1.4 Oxidizers Subcategory

These wastes exhibit the properties listed in 40 CFR 261.21(a)(4) and meet the definitions in 49 CFR 173.151. Several commenters have asked for an elaboration of the oxidizer definition because the DOT definition is not definitive but rather lists examples of oxidizing compounds. The D001 wastes in the Oxidizers Subcategory are primarily inorganic and include such things as waste peroxides, perchlorates, and permanganates. The Agency has very limited information on the generation and characterization of D001 wastes in this subcategory. Currently, generators must assess wastes for oxidizing hazards by considering known oxidizing constituents contained within the wastes and by the definition as outlined in 49 CFR 173.151, which states: "An oxidizer for the purpose of this subchapter is a substance such as chlorate, permanganate, inorganic peroxide, or a nitrate, that yields oxygen readily to stimulate the combustion of the organic matter." The available characterization data for the Oxidizers Subcategory are shown on Table A-4 in Appendix A.

In other words, the presence of any amount of the above substances does not indicate that a material is an oxidizer; rather, one or more of these substances must be present in a quantity sufficient to yield oxygen and stimulate combustion.

2.2 Industries Affected

Because of the diversity of industries generating D001 wastes, the Agency will not attempt to describe every industry that generates characteristic ignitable wastes. The following are brief summaries describing by subcategory the industries that will be most affected by the land disposal ban of D001 wastes. Tables A-1 and A-2 in Appendix A present industrial descriptions for RCRA-permitted facilities that generate D001 wastes and D001 wastes mixed with other RCRA-listed wastes, respectively.

2.2.1 Ignitable Liquids Subcategory

As stated previously, the majority of all D001 wastes generated can be identified as ignitable liquids. The Agency has further subcategorized ignitable liquids as high TOC nonwastewaters, low TOC nonwastewaters, and wastewaters. These wastes are generated by almost every industry and represent a significant proportion of all hazardous wastes. They include wastes such as solvents, degreasing compounds, and byproduct liquids, i.e., wastes that can be generated by most industries. Industries generating D001 Ignitable Liquids include petroleum refining, producers of plastics and resins, paints and allied products, plating and polishing, motor vehicle parts and accessories, electronic equipment, agricultural chemicals, wood household furniture, pressed and blown glass, and commercial printing (USEPA 1988e).

2.2.2 Ignitable Compressed Gases Subcategory

The chemicals industry uses compressed gases as reactants in chemical processes. Additionally, many industries use containerized gases for heating and welding purposes. The Agency has identified only three industrial categories as potential generators of gases classified as D001 wastes. The standard industrial classifications (SIC) for the generators are manufacturing industries, conveyors and conveying machinery, and general chemical manufacturing (USEPA 1988e).

2.2.3 Ignitable Reactives Subcategory

The chemicals industry, specifically the nonferrous metals chemicals industry, generates most of the wastes in this subcategory. The Agency has identified only three industrial categories as potential generators of wastes in the D001 Ignitable Reactives Subcategory. The industries include producers of semiconductors and related devices, producers of power-driven hand tools, and the Department of Energy (USEPA 1988e).

2.2.4 Oxidizers Subcategory

Most of these wastes are generated by the chemicals industry as spent oxidizing solutions or byproducts. The Agency has information indicating that the Department of Defense generates D001 oxidizer wastes from the treatment of waste propellants. Other potential generators of these wastes include the chemicals and allied products industries and manufacturers of fertilizers.

2.3 Applicable/Demonstrated Technologies

This section describes the applicable and demonstrated treatment technologies pertinent to the treatment of D001 wastes and current management practices for these wastes. To be applicable, a technology must theoretically be usable to treat the waste in question or a similar waste. To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or of a similar waste.

Most generators of D001 wastes are currently performing some form of treatment, since ignitable wastes are already restricted from placement in surface impoundments, waste piles, land treatment units, and landfills according to 40 CFR 264.229, 264.256, 264.281, and 264.312, respectively. The following is paraphrased from the Code of Federal Regulations (CFR) for disposal requirements for ignitable wastes:

> Ignitable waste must not be placed in a surface impoundment, waste pile, land treatment unit, or landfill, unless the following conditions are met:
>
> - The waste is treated, rendered, or mixed before or immediately after placement in the impoundment so that the resulting waste, mixture, or dissolution of material no longer meets the definition of ignitable waste.
> - The owner or operator of a facility that treats, stores, or disposes of ignitable waste takes precautions to prevent reactions that generate extreme heat or pressure, fire or explosions, or violent reactions; produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health or the environment; produce uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions; damage the structural integrity of the device or facility; or threaten human health or the environment through other like means.
> - The waste is managed in such a way that it is protected from any material or conditions that may cause it to ignite or react.

In addition, a surface impoundment can be used to dispose of ignitable wastes solely for emergencies. Also, ignitable wastes in containers may be landfilled without meeting the above criteria if the wastes are disposed of in such a way that they are protected from any material or conditions that may cause them to ignite. At a minimum, ignitable wastes must be disposed of in nonleaking containers that are carefully handled and placed so as to avoid heat, sparks, rupture, or any other condition that might cause ignition of the wastes; must be covered daily with soil or other noncombustible material to minimize the potential for ignition of the wastes; and must not be disposed of in cells that contain or will contain other wastes that may generate heat sufficient to cause ignition of the waste.

2.3.1 Ignitable Liquids Subcategory

All wastes in the Ignitable Liquids Subcategory (i.e., high TOC nonwastewaters, low TOC nonwastewaters, and wastewaters) are defined as hazardous because of a low flash point that is due directly to the chemical and physical properties of the organics in the waste. Most of these wastes will have a high heating value.

One might assume that it does not matter how the ignitability characteristic is removed as long as the waste ends up nonignitable. Ignitability, however, often reflects the presence of volatile organic compounds (VOCs), which are ozone precursors. If the ignitable wastes are diluted, VOCs will ordinarily be emitted in concentrations far exceeding those emitted by treatment processes in which these volatiles are destroyed. Control of VOC is a legitimate concern under RCRA (section 3004(m)), which specifically calls for minimizing threats to the environment as well as to human health, and the Agency has specifically called attention to control of VOCs in the 1987 proposed rule implementing RCRA section 3004 (m).

Volatile emissions from dilution also may pose a reignition hazard. Dilution of ignitable wastes fails to utilize the wastes' energy value, contravening a fundamental RCRA goal of encouraging recovery of energy from wastes (RCRA section 1002(d)). EPA also believes that allowing dilution of D001 wastes may create an incentive for generators to miscode the listed, prohibited solvent wastes (F001-F005) as D001 wastes, frustrating the treatment requirements for those wastes. Accordingly, the Agency believes that dilution is not an applicable method for treating ignitable wastes.

Technologies appropriate for treatment of organic wastes are those that destroy or recover the organic constituents. The applicable technologies that the Agency identified for treatment of wastes in the Ignitable Liquids Subcategory were incineration, fuel substitution (because of their high heating value), and recovery. The Agency believes that any thermal treatment technology, such as incineration, would completely remove the characteristic of low flash point by destroying the organic constituents, thereby rendering the waste nonignitable. Fuel substitution, like incineration, destroys the organic constituents in the waste. In fuel substitution, however, fuel value is also derived from the waste. Recovery technologies such as distillation and solvent extraction can be used to separate and recover components. Although recovery technologies can recover some components for reuse, often these processes generate residues that may still exhibit the characteristic of ignitability and require further treatment prior to land disposal.

The Agency still believes that incineration, fuel substitution, and recovery are demonstrated to treat wastes in the D001 Ignitable Liquids Subcategory since they are currently being used to treat such wastes. The Agency has data showing that 26 percent of D001 Ignitable Liquids are already treated by incineration, 25 percent are used as a fuel substitute, and 24 percent are recovered for reuse through processes such as distillation. The remaining 25 percent are treated by a variety of other processes (USEPA 1989d).

The Agency has gathered information on low organic aqueous waste streams that would be classified in the D001 Ignitable Liquids Subcategory. The information indicates that these low organic (less than 10 percent) aqueous waste streams have low Btu values and are being treated using wastewater treatment technologies such as wet air oxidation, solvent extraction, steam stripping, carbon adsorption, and biodegradation. The Agency then reviewed information on the treatment of waste streams with a wide range of organic concentrations. An EPA Project Summary (USEPA 1987b) included information on specific technologies used to treat organic wastes. The summary indicated that technologies such as incineration and recovery processes are generally commercially applied for waste streams with a wide range of organic concentrations. This information further supports that incineration and recovery are demonstrated technologies for wastes in this subcategory. The summary also indicated that technologies such as wet air oxidation, solvent extraction, steam stripping, resin adsorption, carbon adsorption, and biological treatment are generally commercially applied for waste streams with 0-10 percent organic concentrations. Based on a review of this information, the Agency believes that wastewater treatment technologies are applicable and demonstrated for low organic concentration waste streams that are in the D001 Ignitable Liquids Subcategory (low-TOC nonwastewaters and wastewaters). A synopsis of the information technology on the applicability of treatment for organic wastes taken from the EPA Project Summary is included as Table 2-1.

2.3.2 Ignitable Compressed Gases Subcategory

The Agency thinks it unlikely that ignitable compressed gas wastes require placement in any type of land disposal unit. The Agency believes that no gas cylinders containing compressed ignitable gases are placed in

Table 2-1 Approximate Ranges of Applicability of Treatment Techniques as a Function of Organic Concentrations in Liquid Waste Streams

Treatment technology	Initial percent organics Commercially applied	Potential extension
Thin film evaporation	>40	>7
Fractional distillation	>7	>0.8
Steam stripping	>4	>0.1
Incineration	>10	>0
Chemical oxidation	0.8 - 4	0.1 - 7
Solvent extraction	1 - 10	0 - 20
Air stripping	0 - 1	0 - 10
Resin adsorption	0 - 5	0 - 10
Carbon adsorption	0 - 0.1	0 - 1
Ozone/UV radiation	0 - 0.1	0 - 1
Wet air oxidation	1 - 2	1 - 10
Supercritical water	NA*	3 - 40

* Not applicable.

Source: USEPA 1987b.

surface impoundments, and that it is physically impossible to deep-well inject these wastes. The Agency recognizes, however, that some D001 cylinders containing compressed ignitable gases may be placed in waste piles. The Agency expects such placement to be temporary since these cylinders are usually returned to distribution facilities to be refilled. The Agency does not intend to prevent short-term storage of cylinders containing ignitable compressed gases (e.g., acetylene, hydrogen).

The Agency identified reuse/recovery of the contents of the cylinder or incineration of the contents as theoretically applicable technologies for all wastes in this category. For compressed gases or low boiling liquids in cylinders, recovery consists of connecting one or more cylinders containing a given gas to a vacuum pump or to the suction side of a compressor. The cylinder is thereby evacuated, and the recovered gas may be stored in a compressed gas tank or as a low-boiling liquid in a closed tank system. The compound can then be transferred to a container to be shipped for reuse by a customer, or it can be reprocessed and purified in the plant prior to repackaging. However, no single recovery system will serve to recover more than one gas at a time in order to avoid contamination. Furthermore, assuming that a compression step is necessary for recovery, then different equipment will be required for gases that remain gaseous during compression as compared to those gases that readily liquify. Recovery by refilling the cylinders for reuse is practiced by many facilities using containerized gases in their processes. Consequently, EPA believes this technology to be demonstrated. In addition, the Agency has established a policy that facilities that manufacture gases do not have to be considered treatment, storage, or disposal facilities (TSDFs) in order to directly refill compressed gas cylinders.

Another applicable technology identified by the Agency is thermal destruction. Technologies such as incineration provide thermal oxidation or thermal reduction of compounds present in the waste gases. Thermal oxidation would apply to those gases that are essentially hydrocarbons or derived from hydrocarbons. Thermal reduction is a term that describes combustion in a condition that is, at least initially, a "starved air" condition. "Starved air" means combustion with less than the stoichiometric amount of oxygen. Thermal reduction is a well-known mode for burning or incinerating nitrogen-containing fuels or wastes to ensure that the organically bound nitrogen is converted to elemental nitrogen rather than nitrogen oxide(s). The gas would have to be vented directly into an incinerator or vented into an appropriate adsorbent material (provided that air emissions can be controlled), followed by incineration of the adsorbed gas/adsorbent material combination. The problem with adsorption as an approach is that the toxic or otherwise hazardous nature of the gases may be only temporarily deactivated by adsorption. To permanently destroy the gas, the activated carbon or other adsorbent needs to be destroyed. Many facilities incinerate containerized gases by venting them directly into an incinerator. Based on the above discussion, the Agency believes that incineration (thermal reduction or oxidation) is demonstrated (Rissmann 1989).

The Agency has also reviewed information on other treatment technologies that are being used to treat wastes in the Ignitable Compressed Gases Subcategory. These technologies included the treatment of pyrophoric gases by remote control penetration and detonation under a column of appropriate scrubbing solution. The information indicates that these gases cannot be vented into an incinerator without considerable risk. Another method reported as being used for some compressed gases was to oxidize them in an aqueous medium. Carbonyl sulfide and methyl mercaptans were reported as being treated by oxidation. Based on this information, the Agency believes that the technologies described above are applicable and demonstrated.

2.3.3 Ignitable Reactives Subcategory

The waste characterization discussion in Section 2.1.3 describes these wastes as nonwastewaters that can ignite when they come into contact with water and release gases; therefore, the Agency considered applicable technologies for this subcategory to be those technologies that remove the characteristic of ignitability. EPA has identified deactivation technologies such as controlled detonation, controlled burning, and controlled treatment with water to be applicable technologies.

As mentioned earlier, radioactive zirconium fines have been included in the D001 Ignitable Reactives Subcategory. For the proposed rule, the Department of Energy (DOE) submitted data that appeared to indicate that this waste can be stabilized to remove the reactivity characteristic. Stabilization is not usually considered to be a method of deactivation; therefore, EPA was concerned that this treatment may be a form of impermissible dilution rather than a chemical reaction (i.e., oxidation) that removes the reactivity characteristic (Hunt 1989). DOE submitted additional information on the stabilization of radioactive zirconium fines with their public comments on the Third Third proposed rule. These data indicate that stabilization is an established technique for safe management of such materials. It accomplishes results equivalent to those of deactivation technologies by isolating and encapsulating the pyrophoric metal fines and thus precluding conditions that could cause ignition or reaction of the material. Additionally, the cement medium provides shielding from the radioactivity.

Some wastes in the D001 Ignitable Reactives Subcategory, such as calcium carbide slag, are often treated by controlled deactivation with water. Other wastes, such as those containing reactive alkali metals (sodium), are often reacted with water under controlled conditions, which typically generates dilute alkaline solutions that can then be neutralized. EPA has identified one facility using hydrolysis as treatment of alkali metals (Yoder 1989). The Agency believes that most, if not all, of the wastes in the D001 Ignitable Reactives Subcategory are being treated in a manner that renders the waste nonignitable and no longer D001 hazardous. Therefore, the deactivation technologies previously described are demonstrated to treat wastes in this subcategory.

2.3.4 Oxidizers Subcategory

For D001 wastes in the Oxidizers Subcategory, deactivation appears to be the primary applicable treatment option. Deactivation with an appropriate chemical reagent renders the waste nonignitable. The Agency has information indicating that the Department of Defense generates D001 oxidizer wastes from the treatment of waste propellants. These wastes should be treated with an appropriate chemical reducing agent under controlled conditions. Also, certain aqueous solutions of waste oxidizers may be useful in the treatment of other hazardous wastes (e.g., permanganates and peroxides can be used to oxidize toxic organics or cyanide wastes). The Agency believes that oxidizer wastes should be deactivated or used as treatment reagents. The treatment or use of these wastes should be performed in tanks and not in surface impoundments because of the potential release of heat and volatile organics during the oxidation/reduction reactions. The Agency has information from the 1986 TSDR Survey (USEPA 1989b) indicating that wastes in the D001 Oxidizer Subcategory can be treated with chemicals (i.e., chemically reduced) to render them nonignitable. Therefore, these technologies are demonstrated.

EPA reviewed information from a facility that generates two waste streams classified in the oxidizer subcategory. They are both off-specification or contaminated swimming pool chlorination chemicals. These chemicals, calcium hypochlorite and trichorocyanuric acid, are DOT oxidizers based upon an available chlorine content greater than 39 percent. When these materials become a waste, they are classified in the D001 Oxidizers Subcategory. These wastes are normally generated as a solid and are routinely disposed of through deactivation by adding the material to large quantitites of water (similar to its use in swimming pools). Following the deactivation, the waste is further treated in a wastewater treatment facility. During deactivation and treatment, there is no release of chlorine gas. The Agency also has information indicating that hydrogen peroxide and nitric acid wastes are oxidizers effectively treated by dissolution in water followed by neutralization. In the case of nitric acid, the diluting in water is needed to prevent any adverse reaction. Recovery and incineration were also described as effective treatment methods for oxidizer wastes.

Additional information gathered on the treatment of oxidizers indicated that most facilities are currently using technologies such as thermal destruction and dissolution in water followed by wastewater treatment to treat oxidizer wastes. Since these technologies also render oxidizer wastes nonignitable, the Agency believes that they are demonstrated.

2.4 Identification of Best Demonstrated Available Technology (BDAT)

This section presents the rationale for the determination of best demonstrated available technology or technologies for D001 wastes. The Agency believes that there are two major options for evaluating potential treatment standards for each D001 characteristic waste subcategory. The first and preferred option is for EPA to promulgate numerical treatment standards; however, numerical standards are difficult to establish for D001 wastes because of the extensive universe of constituents in every waste stream. The second and next preferred option is to promulgate a method or sequence of methods of treatment as BDAT.

The following sections describe the BDAT for each subcategory of D001 wastes. If a waste is a D001 waste because it fits under more than one D001 subcategory, the waste must be treated by the BDAT technologies that are listed for each applicable subcategory (unless the initial treatment produces a non-D001 waste residue). It is possible that the use of the treatment technologies will, for many of these wastes, result in a residual that no longer exhibits any of the characteristics. In this case, the waste is no longer subject to the requirements of Subtitle C of RCRA. However, the use of the treatment technologies designated as BDAT does not imply that the residues from treatment are nonhazardous. In some cases, treatment to remove one characteristic may result in a residue that has a different characteristic and thus requires further treatment. For example, treatment of a D001 waste using incineration may remove the ignitable characteristic but result in an ash that will have an EPA toxic characteristic for metals and will need metals treatment. The treatment standards being promulgated for all D001 wastes are summarized in Table 2-2 located at the end of this section.

It is important to note that management practices have been established for ignitable wastes in surface impoundments, waste piles, land treatment units, and landfills (see 40 CFR 264.229, 264.256, 264.281, and 264.312, as well as 265.229, 265.256, 265.281, and 265.312). When finalized, the treatment standards promulgated for ignitable (D001) wastes will supersede the above-mentioned provisions and exclusions for permissible land disposal of these waste outlined in Parts 264 and 265. Facilities handling ignitable wastes will have to comply with the promulgated treatment standards for these wastes in order to land dispose them.

The Agency is superseding the regulatory sections referenced above to avoid potential conflicts between the promulgated treatment standards and existing Part 264 and 265 land disposal provisions for D001 wastes. The Agency believes that protection of human health and the environment will be better accomplished by the promulgated standards since compliance with the treatment standards will render these waste nonhazardous by permanently eliminating the characteristic (i.e., ignitability).

2.4.1 Ignitable Liquids Subcategory

The Agency first studied the option of transferring the standards for these constituents from the corresponding F001-F005 standards promulgated in the November 7, 1986, final rule (51 FR 40642) since some D001 ignitable liquids have been shown to contain organic constituents that are also constituents in F001-F005 solvents. However, the Agency believes that this option would create an unnecessary burden on the regulated community because the majority of D001 wastes in the Ignitable Liquids Subcategory should not contain F001-F005 constituents. Most D001 wastes containing F001-F005 constituents are probably cases of misclassification. The misclassification of F001-F005 wastes as D001 is currently one of the largest EPA enforcement issues in the RCRA program. Therefore, the Agency believes that the problem is best handled through enforcement rather than by establishing numerical treatment standards for misclassified wastes.

EPA considered a second option by examining all demonstrated technologies to determine whether one method performs better than another. Thermal destruction technologies such as incineration and reuse as a fuel will completely remove the characteristic of low flash point by destroying the organic constituents, thereby rendering the waste nonignitable. The Agency does not want to preclude the use of distillation or other recovery techniques for these wastes. At the same time, the Agency does not believe that most of these wastes are necessarily recoverable by processes such as distillation. Furthermore, distillation still bottoms may be ignitable and require further treatment.

While recovery options may be preferable to incineration or fuel substitution for some of the D001 wastes in this treatability group, the end result must be the same (i.e., the residues must not be ignitable). The choice among incineration, fuel substitution, or recovery can then be made by the generator or treater, based on economics and on the ability of the particular recovery system to handle the waste. As previously described, the Agency received many comments indicating that most of the low organic, aqueous D001 wastes are best treated using wastewater treatment technologies such as wet air oxidation, steam stripping, carbon adsorption, and biodegradation. The Agency did not originally propose wastewater treatment technologies as BDAT because of concerns over air emissions of volatile organic compounds (VOCs) from some of these wastewater treatment processes. Several commenters said that some D001 aqueous wastes contain organics that are water soluble and can be biodegraded in some biological wastewater treatment systems. Typically, these constituents must be diluted to significantly lower concentrations in the wastewater in order for the microorganisms to degrade them. Also, the biodegradation processes often require an aeration step during which significant amounts of VOCs can be emitted. EPA believes, however, that VOC emissions can be controlled by altering operating parameters (e.g., aeration rates, temperatures, etc.) and by performing process steps such as aeration and dilution steps in controlled environments such as tanks equipped with air pollution control devices. The Agency believes that some facilities are already practicing these precautions. The Agency has information on an anaerobic biodegradation system used to treat D001 wastes that was designed to keep any air emissions contained inside the system.

Based on information including an EPA Project Summary entitled Technical Resource Document Treatment: Technologies for Solvent-Containing Wastes (USEPA 1987b), the Agency believes that wastewater treatment technologies are applicable for the treatment of certain wastes in the D001 Ignitable Liquids Subcategory. The EPA project summary provides information on the applicability of treatment technologies as a function of organic concentrations in liquid waste streams. To identify the treatment technologies that are BDAT for various D001 ignitable liquids, the Agency further subcategorized D001 ignitable liquids into three treatability groups as follows: (1) D001 ignitable liquids high TOC nonwastewaters, (2) D001 ignitable liquids low TOC nonwastewaters, and (3) D001 ignitable liquids wastewaters.

The ignitable liquids high TOC nonwastewaters subcategory is defined as D001 wastes containing greater than or equal to 10 percent TOC as generated. These wastes have large organic concentrations, high BTU values, and low water contents. Thermal destruction technologies such as incineration and fuel substitution completely remove the characteristic of ignitability in these wastes by destroying the VOCs. Many of these wastes are excellent candidates for fuel substitution because of high BTU values. It is common practice to recover reusable organic materials from these wastes using recovery processes such as distillation, steam-stripping, and liquid-liquid extraction. Therefore, the Agency is promulgating a treatment standard of "Incineration (INCIN), Fuel Substitution (FSUBS), or Recovery (RORGS) as Methods of Treatment" for this subcategory. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

The Agency believes it appropriate to require that these wastes be treated by some type of destruction and recovery technology given that they often contain high concentrations of toxic organic constituents that provide the ignitability characteristic to the waste. The toxics in these wastes might not be destroyed if the waste could be land disposed as long as it is not ignitable at the point of disposal.

The D001 ignitable liquids low TOC nonwastewaters subcategory is defined as wastes that contain greater than 1 percent but less than 10 percent TOC as generated. The D001 ignitable liquids wastewaters subcategory is defined as wastes that contain less than 1 percent TOC and less than 1 percent TSS as generated. These wastes generally do not have high BTU contents because of their high water content and low organic concentrations.

The Agency believes that some of these wastes can be effectively treated (i.e., the characteristic of ignitability can be removed by either destroying or recovering the organic constituents that gave the waste its ignitable character) using technologies applicable for treatment of aqueous wastes. In some cases, these wastewaters and low TOC nonwastewaters may need to be mixed with other wastewaters to achieve an organic concentration desirable for proper operation of a treatment system for aqueous wastes. For instance, wastewaters destined for biological treatment are often commingled to achieve an organic concentration that is optimal for the microorganisms. Fuel substitution is not considered practical since wastes in both these categories generally do not have BTU contents because they contain mostly water. Although most of these wastes can be effectively treated using wastewater technologies, incineration may also be applicable especially for low TOC nonwastewaters. Based on this information, EPA is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Ignitability" for both the D001 ignitable liquids low TOC nonwastewaters and the D001 ignitable liquids wastewaters subcategories. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five letter technology code in parentheses.

Although most wastes in the ignitable liquids low TOC nonwastewaters subcategory and ignitable liquid wastewaters subcategory will not be amenable to recovery (especially wastewaters), the Agency does not want to preclude the use of recovery techniques for deactivation of these wastes. The choice between treatment or recovery for deactivation may be made by the generator or treater, based on economics and on the ability of a particular recovery system to handle a waste stream. EPA considers processes that separate an organic phase to be recovery (or in some cases pretreatment) and, hence, acceptable treatment provided the separated organic phase is reused or further treated by a technology that will remove the characteristic of ignitability. The aqueous phase would not require further treatment unless it still exhibited the ignitibility characteristic (assuming the aqueous phase is not hazardous for any other reason).

2.4.2 Ignitable Compressed Gases Subcategory

The Agency believes that a numerical standard is not practical for this subcategory because of the variety of gases that are listed as D001. The Agency considered the demonstrated technologies for treatment technology-based standards for compressed ignitable gases. The preferred (and most likely application) is recovery by direct reuse. Typically, the contents of the cylinders and the cylinders themselves are directly reused (i.e., refilled). The second technology that the Agency considered was incineration by venting the gas onto an incinerator or by venting the gas into an appropriate adsorbent material (provided that air emissions can be controlled), followed by incineration of the adsorbed gas/adsorbent material combination. There may be cases when this will be preferred over the direct venting of the gas into the incinerator (e.g., to reduce the risk of explosion). To comply with the treatment standard in this case, however, the adsorbed gas must be incinerated to destroy or remove the characteristic permanently.

The Agency also reviewed information on additional treatment technologies that could be used to remove the characteristic of ignitable compressed gases. This information indicated the reuse option is viable within the compressed gas industry, except for cases such as cylinders that have defective valves, that have lost the identity of the manufacturer, that are lecture bottle size, and that are damaged. In any of these four cases, the contents in the cylinders must instead be treated. According to this information, the most prevalent treatment method is to feed the ignitable gas into a furnace as a fuel source. Typical compressed gases include the following: propane, methane, butane, hydrogen, ethane, and acetylene. Therefore, the Agency believes that fuel substitution is an appropriate treatment technology for ignitable compressed gases.

The Agency also reviewed information concerning a less common class of gases in this subcategory called pyrophorics. These gases, because of their air-reactive characteristics, cannot be vented into an incinerator without considerable risk. A method of treatment for such gases was found to be remote control penetration and detonation under a column of appropriate scrubbing solution. Typical gases in this class are tributyl aluminum, triethylborane, and tetramethyltin. Another method of treatment to deactivate the ignitable characteristic in some compressed gases was described as oxidation in an aqueous medium. Carbonyl sulfide and methyl mercaptans were noted as being effectively treated by such oxidation.

It was also found that small-volume containers of ignitable compressed gases (e.g., aerosol cans of 18 oz or less) can be fed to a kiln and vented within the kiln itself by the melting of the small cans. The vented gases are then incinerated in the kiln or afterburner. The aerosal cans are fed to the kiln at a controlled rate based on the specific kiln.

The Agency believes that all the technologies described above can be used to effectively treat compressed gases and permanently remove the characteristic of ignitability. As a result, the Agency is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Ignitability" for the Ignitable Compressed Gas Subcategory. The Agency has established this standard to allow the regulated community the flexibility to use the "best" technology for the specific gaseous waste. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this technology standard. See also 40 CFR 268.42, Table 1, for a detailed description of all technologies referred to by a five letter technology code in parentheses.

The treatment standard being promulgated will apply to all forms of the ignitable compressed gases since the definitions of wastewater and nonwastewater do not apply to this group of wastes. This standard will allow the flexibility to use the "best" technology for the specific gaseous waste.

2.4.3 Ignitable Reactives Subcategory

The Agency believes that the development of a method of treatment is better than establishment of a numeric standard for ignitable reactive wastes. Any numerical treatment standards based on the demonstrated deactivation technologies (i.e., chemical deactivation, thermal destruction) would be difficult because there is no known analytical test designed to measure uniformly and equitably the ignitability of these reactive materials. Additionally, there are no EPA-approved tests that distinguish the reactive chemical from the deactivated chemical (e.g., sodium).

Information does suggest that all these wastes can be treated by some form of deactivation (e.g., thermal destruction and controlled chemical deactivation) to remove the characteristic of ignitability for the D001 Ignitable Reactives. However, the Agency has determined that within the D001 Ignitable Reactives Subcategory there appears to be a further variety of different waste groups, each with a certain degree of uniqueness with respect to hazard and handling requirements. Therefore, the Agency believes that the actual method of deactivation chosen for each waste may be specific to that waste and may be best determined by the generator or the treater most knowledgeable as to the waste's unique hazards and handling requirements. Furthermore, the Agency currently has no information that suggests that one particular technology may be generally applicable to all wastes within the D001 Ignitable Reactives Subcategory, nor that there is one particular technology that can be identified as "best."

Current management practices for some ignitable reactive wastes, such as calcium carbide slag, involve treatment by controlled deactivation with water. EPA reviewed information on various other technologies used for the treatment of wastes in the D001 Ignitable Reactives Subcategory. Technologies for treatment of ignitable reactive wastes such as reactive alkali metals (sodium or potassium) were chemical deactivation, stabilization, recovery, and incineration.

The Agency believes that the technologies described above can effectively treat wastes in the D001 Ignitable Reactives Subcategory. However, the Agency believes that because of the diversity in physical and chemical forms of the wastes in this subcategory, it is not possible to determine a "best" technology for all wastes. As a result, the Agency is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Ignitability" for wastes in this D001 subcategory. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this technology standard. See also 40 CFR 268.42, Table 1, for a detailed description of all technologies referred to by a five-letter technology code in parentheses. This treatment standard is established only for nonwastewaters since ignitable reactive wastes are described as being very reactive with water and hence cannot exist as wastewaters.

2.4.4 Oxidizers Subcategory

The Agency considered monitoring the treatment of wastes in this group by the use of a sensor called an oxidation reduction potential (ORP) cell. The ORP sensor electronically measures, in millivolts, the level to which the oxidation-reduction reaction has proceeded at any given time. However, the ORP reading is pH dependent and varies by the type of oxidizer. Additionally, the Agency has determined that within the D001 Oxidizers Subcategory there appears to be a further variety of different waste groups, each with a certain degree of uniqueness with respect to hazard and handling requirements. As a result, EPA does not believe that all wastes in this category are amenable to oxidation-reduction treatment (e.g., nonwastewaters) and that the actual method of deactivation chosen for each waste may be specific to that waste. Deactivation technologies may be best determined by the generator or the treater most knowledgeable as to the waste's unique hazards and handling requirements. EPA has identified incineration and neutralization as demonstrated technologies for wastes in the D001 Oxidizers Subcategory. However, the Agency currently has no information that suggests that one particular technology may be generally applicable to all wastes within the D001 Oxidizers Subcategory, nor that there is one particular technology that can be identified as "best."

The Agency believes a treatment standard of "Deactivation" for wastes in the D001 Oxidizers Subcategory is appropriate because for these wastes the hazardous characteristic is based on imminent hazard (i.e., oxidizers can react violently with organics or other materials and result in the rapid generation of fires) rather than on other criteria such as levels of hazardous constituents, and because technologies exist that can completely remove this characteristic. Therefore, the Agency is promulgating a treatment standard of "Deactivation to Remove the Characteristic of Ignitability" for wastes in the D001 Oxidizers Subcategory. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this technology standard. See also 40 CFR 268.42, Table 1, for a detailed description of all technologies referred to by a five-letter technology code in parentheses. This standard will give the regulated community the flexibility to determine the "best" treatment based on the physical and chemical characteristics of the oxidizer wastes.

Table 2-2 BDAT Treatment Standards for D001

IGNITABLE LIQUIDS
261.21(a)(1)
[Nonwastwaters]
(High TOC Ignitable Liquids Subcategory - Greater than or equal to 10% total organic carbon)

INCINCERATION (INCIN), FUEL SUBSTITUTION (FSUBS), OR RECOVERY (RORGS) AS METHODS OF TREATMENT*

IGNITABLE LIQUIDS
261.21(a)(1)
[Nonwastewaters]
(Low TOC Ignitable Liquids Subcategory - Less than 10% total organic carbon)

DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITIBILITY*

IGNITABLE LIQUIDS 261.21(a)(1)
[Wastewaters]

DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*

IGNITABLE COMPRESSED GASES SUBCATEGORY**
261.21(a)(3)

DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*

Table 2-2 (continued)

IGNITABLE REACTIVES SUBCATEGORY 261.21(a)(2) [Nonwastewaters]
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*

IGNITABLE OXIDIZERS SUBCATEGORY 261.21(a)(4) [Nonwastewaters and Wastewaters]
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF IGNITABILITY*

* Incinerators must comply with 40 CFR, 264 Subpart O or 265 Subpart O. Fuel substitution units must be in compliance with 40 CFR Part 266 Subpart D. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in a combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

** Ignitable gases may be vented directly into an incinerator or reactor or vented into a suitable adsorbent prior to treatment. Although the gases, once vented, are no longer compressed in a cylinder, the Agency does not consider that treatment has occurred until the ignitable gas has been incinerated or otherwise treated. Adsorption of the ignitable gas into either a solid or liquid adsorbent is typically a reversible physical process. Thus, the ignitable chemical has not been destroyed.

3. CHARACTERISTIC CORROSIVE WASTES (D002)

According to 40 CFR 261.22(a), there are two criteria for defining a waste as a D002 corrosive waste. Paraphrasing these criteria, a waste can be a D002 waste if (1) it is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5 or (2) it is a liquid and corrodes steel at a specified rate at a specified temperature.

EPA determined that these criteria translate into three subcategories for D002 wastes. The first two subcategories are classified as the D002 Acid Subcategory and the D002 Alkaline Subcategory and refer to those D002 wastes that exhibit the properties listed in 40 CFR 261.22(a)(1). The D002 Acid Subcategory is defined as those wastes with a pH of less than or equal to 2, and the D002 Alkaline Subcategory is defined as those wastes with a pH of greater than or equal to 12.5. Also by definition, D002 wastes in the Acid Subcategory and Alkaline Subcategory include only wastes that are considered to be "aqueous." This is because standard pH measurement can be performed only in the presence of water (i.e., pH is an indication of the concentration of hydrogen ions in water). The third subcategory is classified as the D002 Other Corrosives Subcategory and is defined as those D002 wastes that exhibit corrosivity to steel as listed in 40 CFR 261.22(a)(2). These are often nonaqueous corrosive wastes such as certain organic liquids. They may also be aqueous liquids with a pH between 2 and 12.5.

3.1 Waste Characterization

The Agency realizes that the compositions of D002 can vary significantly, and hence it is impossible to characterize every D002 waste stream that can be generated. Consequently, the Agency based its BDAT development on generalizations from the definition in 40 CFR and limited characterization data. The data available for D002 single waste streams are shown in Table B-1 in Appendix B.

Most of corrosive wastes are acidic (82 percent) and inorganic (82 percent) and are characterized as dilute (94.3 percent liquids). Typically, corrosive wastes that are disposed of by deep well injection are likely to contain toxic organics, whereas landfilled wastes are likely (38 percent) to contain heavy metals (Wilk, Palmer, and Breton 1988).

3.1.1 Acid/Alkaline Subcategories

D002 wastes in the Acid Subcategory commonly include concentrated spent acids, acidic wastewaters, and spent acid strippers and cleaners. Similarly, those wastes in the Alkaline Subcategory typically include concentrated spent bases, alkaline wastewaters, and spent alkaline strippers and cleaners. Most D002 wastes generated are in the Acid Subcategory. Wastes from both subcategories are generated by almost every industry and represent a significant proportion of all hazardous wastes.

3.1.2 Other Corrosives Subcategory

D002 wastes in the Other Corrosives Subcategory are generated on a sporadic basis and generally in low volumes. The Agency suspects that these wastes are often identified as corrosives without performing the specified testing with steel (i.e., the corrosivity of the waste may be assumed because of the presence of known corrosive constituents). This may also be due, in part, to the high cost of testing and to the difficulties in finding laboratories that are experienced in steel corrosion testing.

The physical and chemical characteristics of this group of wastes vary greatly. These wastes may be aqueous or organic. In addition, a large variety of corrosive chemicals may be constituents in this type of corrosive waste. The ability of the waste to corrode the tested steel (i.e., SAE 1020 steel) depends on the concentration of corrosive chemicals. Chemicals that may contribute to this corrosivity include ferric chloride, benzene sulfonyl chloride, benzotrichloride, acetyl chloride, formic acid, hydrofluoric acid, some catalysts, various resins, metal cleaners, and etchants. Highly concentrated acids that have no water content may also be included in this subcategory since pH measurements are not possible on these types of wastes.

3.2 Industries Affected

Because of the diverse nature and magnitude (over 2,500 generators) of the industries generating D002 wastes, EPA will not attempt to describe every industry that generates characteristic corrosive wastes. Table B-1 in Appendix B presents information from a number of RCRA permitted facilities that generated D002 wastes in 1986. The approximate volumes produced and a description of the industries generating the wastes are included on the table. This information has been gathered from the 1986 EPA Generator Survey. Confidential business information is not included. Table B-2 provides industrial generation information on a percentage basis (Wilk, Palmer, and Breton 1988).

3.2.1 Acid/Alkaline Subcategories

Wastes from both of these subcategories are generated by nearly every industry and represent a significant proportion of all hazardous wastes. The primary industrial applications for acids and bases that result in generation of corrosive wastes are (1) use as chemical intermediates in the inorganic and organic chemical manufacturing industries; (2) use as metal cleaning agents in metal production and fabrication industries; and (3) use in boiler blowdown and stack gas treatment, primarily in electricity generating facilities. Other significant corrosive waste sources include refining processes in the petroleum industry and pulping liquor in the paper industry.

3.2.2 Other Corrosives Subcategory

Most of these wastes are generated by the chemicals industry and are byproducts or cleaning wastes. Concentrated phenolics generated by the petroleum industry are included in this subcategory. "Other organic liquids" classified as D002 are generated by the noncellulosic organic fibers industry, the plastic materials and resins industry, and the paper coating and glazing industry.

3.3 Applicable/Demonstrated Technologies

This section describes the applicable and demonstrated treatment technologies pertinent to the treatment of D002 wastes. To be applicable, a technology must theoretically be usable to treat the waste in question or a similar waste. To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or a similar waste.

3.3.1 Acid/Alkaline Subcategories

These subcategories have been defined as hazardous because of their extremes in pH. The technology identified by EPA as applicable for treatment of these wastes are technologies that neutralize the waste, thereby rendering it noncorrosive with respect to pH (i.e., pH less than 2 or greater than 12.5). Any neutralization technology (i.e., the addition of acid or alkali to change the pH to an appropriate value) will completely remove the characteristic of corrosivity. Many facilities generate waste streams from both the acid subcategory and the alkaline subcategory (often from different processes). These facilities commonly use these acid and alkaline waste streams to neutralize each other. This situation also occurs at commercial hazardous waste treatment facilities, in that the facilities will take acid wastes from various generators and neutralize them with alkaline wastes from other generators. The Agency has information indicating that most D002 wastes in both the acid and alkaline subcategories are already being treated by neutralization; thus, neutralization is demonstrated to treat such wastes (USEPA 1989c).

Commercial acid and bases (neutralizing reagents) are also used to complete neutralization processes and often are used only for pH adjustment of final wastewater discharges. The choice of neutralizing reagents is dependent upon the subcategory of the waste, i.e., the acid wastes will require bases for neutralization and alkaline wastes will require acids. Alkaline reagents commonly used to neutralize strongly acidic waste streams include high-calcium lime and caustic soda. For the treatment of dilute acidic waste streams, limestone treatment may also be feasible. Mineral acids such as sulfuric or hydrochloric acid are the primary reagents used for the neutralization of corrosive alkaline waste streams (Wilk, Palmer, and Breton 1988).

Pretreatment requirements prior to neutralization typically consist of gross solids removal (i.e., filtration), flow equalization, or treatment of individual waste streams before combining with other process wastes. Treatment of segregated wastes for purposes other than pH adjustment results in economic benefits from reduced reagent costs and smaller equipment sizing. Common pretreatment processes include cyanide destruction, chromium reduction, metals precipitation from highly chelated wastes, and oil removal.

The Agency reviewed information indicating that incineration is also applicable for D002 wastes, especially for organic acids, mixed D001/D002 waste streams, and other D002 wastes with organic constituents. Pollution control devices on incinerators remove corrosive gases from burning D002 wastes, and scrubber waters can be neutralized if necessary. The Agency also has data indicating that many D002 waste streams are currently being incinerated. Therefore, the Agency believes that this technology is demonstrated for D002 wastes.

In addition to neutralization and incineration technologies, the Agency has information indicating that several facilities are recovering wastes belonging to the D002 Acid Subcategory and D002 Alkaline Subcategory. Hence, the Agency believes that recovery technologies are also demonstrated to treat D002 acid and alkaline wastes.

3.3.2 Other Corrosives Subcategory

For D002 wastes in the Other Corrosives Subcategory, deactivation (i.e., chemical treatment) appears to be an applicable treatment option. In some cases, deactivation of the corrosive constituents of the waste with an appropriate chemical reagent will render the constituent noncorrosive. An example of this treatment would be the reaction of benzene sulfonyl chloride with dilute sodium hydroxide solution under carefully controlled conditions, which will yield a solution containing sodium benzene-sulfonate and sodium chloride that no longer has any of the characteristics of a hazardous waste.

Incineration of D002 wastes that contain high concentrations of corrosive organics is also a common practice. The Agency received information from facilities that are currently incinerating wastes in this subcategory. Based on this information, the Agency believes that this technology is applicable. Since the Agency has now identified several facilities incinerating wastes in this subcategory; incineration is also demonstrated.

Removal and recovery of either organic or inorganic corrosive constituents may also be an applicable technology that could render these wastes noncorrosive. Recovery could involve extraction of the corrosive constituents, until the waste itself is no longer considered corrosive (to SAE 1020 steel). Organics present in the wastewater may be recovered by technologies such as distillation, steam stripping, solvent extraction, or thin film evaporation. The Agency has identified at least one facility using recovery technologies for treatment of D002 wastes in this subcategory and, therefore, recovery is demonstrated to treat D002 wastes (USEPA 1989d).

3.4 Identification of Best Demonstrated Available Technology (BDAT)

The Agency believes that there are two major options for evaluating potential treatment standards for D002 characteristic wastes: (1) propose numerical treatment standards and (2) establish a method of treatment.

It is important to point out that the residues from all neutralization processes may possibly be considered hazardous wastes by other hazardous waste definitions. In particular, the neutralization sludge residues may exhibit the characteristic of EP toxicity for metals. Residues from the treatment of D002 wastes, if hazardous, will be subject to the appropriate treatment standards.

3.4.1 Acid/Alkaline Subcategories

EPA considered a treatment standard of "Base Neutralization to pH 6 to 9 and Insoluble Salts" for the D002 Acidic Subcategory. Likewise, EPA considered a treatment standard of "Acid Neutralization to pH 6 to 9 and Insoluble Salts" for the D002 Alkaline Subcategory.

The Agency considered requiring neutralization to a pH of 6 to 9 instead of pH 2 to 12.5 for several reasons. First, hydronium ions from acids solubilize metals from clay liners, impacting their ability to act as barriers to migration. Moreover, acid wastes between pH 2 and 6 can increase the mobility of many hazardous constituents in ground water relative to wastes in the pH range of 6 to 9. Another reason the Agency considered pH 6 to 9 was that this range matches the buffering of natural aquatic systems based on carbonate/bicarbonate pH relationships (i.e., pH 5.5 and 8.5 are carbonate/bicarbonate pH levels, indicating what are referred to as the acidity and alkalinity (respectively) of an aqueous environmental sample).

EPA reviewed much information pertaining to the pH range of 6 to 9 for D002 acid and alkaline wastes. Some of this information indicates that a 6 to 9 pH requirement would cause operational problems (such as plugging) in underground injection wells. Many injection wells operate at a pH of less than 6 so metals do not precipitate out of solution and cause plugging problems in either the injection unit itself or further inside the well. Specific pH ranges are typically required in permits for many underground injection wells and are typically at levels less than pH 6 to ensure that injected fluid flows properly through the injection zone without plugging.

Other information indicates that requiring a pH of 6 to 9 would cause severe disruptions in most metals removal treatment systems. A pH of 10 is often considered optimum for removal of most metals from wastewaters. These treatment systems generally consist of chemical precipitation in tanks to remove metals followed by neutralization of the effluent in surface impoundments prior to discharge.

The Agency also received information documenting enormous disruptions of existing wastewater treatment systems that would occur with a 6 to 9 pH requirement. For example, every surface impoundment or injection well receiving commingled wastes (some of which were D002 corrosive wastes at the point of generation, but once commingled were above pH 2 (or below pH 12.5) and therefore no longer considered hazardous by 40 CFR 261.22) that were outside of the pH 6 to 9 range would be in violation of the standard. This would affect thousands of such units (most of which are RCRA Subtitle D units and hence not presently affected by RCRA Subtitle C).

The Agency also knows of a facility that is treating an acidic D002 waste only to a pH of 4.5 prior to commingling with other wastes that require biodegradation. This is done to counter the production of alkaline ammonia during the biodegradation process and thereby aids in maintaining a "neutral" pH in the biodegradation process.

As a result of information reviewed on pH ranges and for the reasons mentioned below, the Agency is not promulgating a pH range of 6 to 9. EPA believes that the following citations indicate precedence in the Agency's position of defining neutralization as treatment for corrosive wastes. In 40 CFR 260.10, EPA defines "treatment," in part, as "... any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, ..., or so as to render such waste nonhazardous, or less hazardous; ..." (emphasis added). In addition, 40 CFR 260.10 also defines, in part, an "elementary neutralization unit" as "... a device which: (1) Is used for neutralizing wastes that are hazardous only because they exhibit the corrosivity characteristic defined in 261.22 of this chapter, or they are listed in Subpart D of Part 261 of the chapter only for this reason; ..." (emphasis added). Thus, the Agency believes that any process that removes the corrosive characteristic of wastes in the D002 Acids and Alkaline Subcategories (i.e., a process that changes the pH levels to greater than 2 but less than 12.5) thereby renders these wastes "nonhazardous" and is therefore considered to be treatment by virtue of the policy established in the aforementioned citations.

EPA believes that while desirable in some cases, "neutralization" of wastes in the D002 Acidic and Alkaline subcategories does not have to be accomplished specifically through the use of the corresponding neutralization chemicals (i.e., acids to neutralize the alkaline subcategory and bases to neutralize the acidic subcategory). Almost all chemicals (including water, which dissociates into hydronium and hydroxide ions) have some acid character (acidity) and some basic character (alkalinity) depending upon the reference chemical. According to the "Lewis Acid Theory," an acid is a substance that can take up an electron pair to form a covalent bond and a base is a substance that can furnish an electron pair to form a covalent bond. Thus, an acid is an electron-pair acceptor, and a base is an electron-pair donor. A proton is an acid because it is deficient in electrons and needs an electron pair to complete its valence shell. Hydroxide ion is a base because it contains electron pairs available for sharing (Morrison and Boyd 1983). As previously mentioned, almost all chemicals have both these qualities to some degree.

Furthermore, if the Agency required treatment with specific chemicals (i.e., acids and bases) to achieve the treatment standard, it is not always necessary to use chemicals that are specifically identified as commercial acids or bases to achieve treatment of D002 wastes. In fact, many facilities generate both acidic and alkaline wastes (often from different processes) and commonly use them to neutralize each other. This situation also occurs at commercial hazardous waste treatment facilities, in that the facilities take acid wastes from various generators and neutralize them with alkaline wastes from other generators. In general, commercial acids and bases are used to complete the neutralization processes and often are used only for pH adjustment of the final wastewater discharges. The mixing of D002 corrosive wastes with other wastewaters (even other acidic, noncorrosive wastes) will contribute to an overall neutralization due to the resultant change in pH. This is because pH is merely a measure of the concentration of hydronium ions (H^+) in water and is dependent upon the equilibrium constant for the dissociation of water into hydronium and hydroxide ions (as previously discussed). As more water is present, the equilibrium will be shifted and thereby increase the pH; resulting in "neutralization." Because of this, EPA is specifically allowing mixing of D002 wastes with each other and with other wastewaters to remove the characteristic of corrosivity (i.e., resulting in a pH between 2 and 12.5). However, EPA's allowance of mixing wastes to remove corrosivity does not override other prohibitions on dilution of wastes for other purposes (i.e., this does not override other dilution prohibitions that may be applicable for other wastes).

The Agency believes that it is important to consider the solubility of the salts produced as a result of neutralization. The Agency believes that wastewater discharges with high concentrations of dissolved salts, such as sodium sulfate, could enhance algal growth and potentially have adverse impacts on freshwater ecosystems. Therefore, EPA considered, as part of the D002 acids and alkaline treatment standards, neutralization and formation of insoluble salts, even though they would result in an insoluble sludge that would require landfilling.

The Agency reviewed much information concerning the generation of insoluble salts. This information indicates that neutralization and formation of insoluble salts is either impractical or technically impossible for some commonly used acids and bases that become D002 wastes such as organic acids, nitric acid, sodium hydroxide, potassium hydroxide, hydrochloric acid, and other acid halides. Because the common salts generated from the neutralization of these particular acids and bases are very soluble in water, the proposed requirement to generate insoluble salts would result in treatment with exotic chemicals in order to comply (if creation of an insoluble salt is possible at all). This is further supported by the fact that almost all nitrate and chloride salts of the major metals are very soluble in water. The most insoluble chloride salts are mercurous chloride and silver chloride. A requirement to form these salts would be impractical and may even be the generate of a hazardous waste. Information on the solubility of salts is presented in Table 3-1.

EPA also recognized that requiring the formation of insoluble salts would negate using alkaline and acidic process wastes generated onsite to co-neutralize each other. This would, in effect, result in double the volume of insoluble salts that would have to be disposed of and would use up valuable virgin commercial acids and bases that otherwise would not be needed. As stated in the preceding sections of this discussion on corrosive wastes, the Agency does not intend to preclude such onsite neutralization with wastes and believes that this would probably result in an unnecessary use of virgin materials for waste treatment.

Additionally, in many cases for D002 wastes that contain organics, neutralization is often a necessary pretreatment step for other treatment processes (such as steam stripping, biological treatment, and/or carbon adsorption) that remove or destroy the organics in the waste. If a sludge must be formed during the neutralization process, organic constituents that could have been destroyed or removed while in the wastewaters are instead transferred to the solid phase where they will be either disposed of untreated or where they may require treatment with incineration.

Table 3-1 Solubility Information

Table of Solubilities

	Acetate	Bromide	Carbonate	Chlorate	Chloride	Chromate	Hydroxide	Iodine	Nitrate	Oxide	Phosphate	Silicate	Sulfate	Sulfide
Aluminum	S	S		S	S		A	S	S	a	A	I	S	d
Ammonium	S	S	S	S	S	S		S	S		S		S	S
Barium	S	S	P	S	S	A	S	S	S	S	A	S	a	d
Calcium	S	S	S	S	S	S	S	S	S	P	P	P	P	P
Cupric	S	S		S	S		A		S	A	A	A	S	A
Ferrous	S	S	P	S	S		A	S	S	A	A		S	A
Ferric	S	S		S	S	A	A	S	S	A	P		P	d
Lead	S	S	A	S	S	A	P	P	S	P	A	A	P	A
Magnesium	S	S	P	S	S	S	A	S	S	A	P	A	S	d
Manganese	S	S	P	S	S		A	S	S	A	P	I	S	A
Mercurous	P	A	A	S	a	P		A	S	A	A		P	I
Mercuric	S	S		S	S	P	A	P	S	P	A		d	I
Potassium	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Silver	P	a	A	S	a	P		I	S	P	A		P	A
Sodium	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Stannous	d	S		S	S	A	A	S	d	A	A		S	A
Stannic	S	S			S	S	P	d		A			S	A
Stroatium	S	S	P	S	S	P	S	S	S	S	A	A	P	S
Zinc	S	S	P	S	S	P	A	S	S	P	A	A	S	A

S = soluble in water; A = soluble in acids, insoluble in water; P = partially soluble in water, soluble in dilute acids; I = insoluble in dilute acids and in water; a = slightly soluble in acids, insoluble in water; d = decomposes in water.

Rules of Solubility

1. Common sodium, potassium, and ammonium compounds are soluble in water.
2. Common nitrates, acetates, and chlorates are soluble.
3. Common chlorides are soluble except silver, mercurous, and lead. (Lead chloride is soluble in hot water.)
4. Common sulfates are soluble except calcium, barium, strontium, and lead.
5. Common carbonates, phosphates, and silicates are insoluble except sodium, potassium, and ammonium.
6. Common sulfides are insoluble except calcium, barium, strontium, magnesium, sodium, potassium, and ammonium.

Source: Castka 1962.

As a result of the information discussed, the Agency does not believe that requiring neutralization to insoluble salts and the use of acids and bases to provide neutralization for wastes in the D002 acid and alkaline subcategories is the "best" technology.

The Agency also reviewed information indicating that incineration is applicable for D002 wastes, especially for organic acids, mixed D001/D002 waste streams, and other D002 wastes with organics. Pollution control devices on incinerators will remove corrosive gases from the burning of these D002 wastes. Alkaline scrubber waters are often employed in these air pollution control devices in order to neutralize acidic emissions.

Recovery options have been demonstrated for a variety of corrosive wastes. The Agency prefers recovery as a treatment standard, in that it results in no discharge of acidic or alkaline constituents into the environment and conserves resources. The legislative history of the land disposal restriction provisions also indicates that recovery is the preferred management alternative. The Agency lacks waste characterization data that indicate the wastes that are most amenable to recovery; therefore, the choice between treatment and recovery may be made by the generator or the centralized treatment operation, according to the applicability and performance of a given type of acid/base recovery system.

The Agency considered promulgating a treatment standard as a specified technology, namely "Neutralization." However, the Agency found that in certain case, "incineration" and "recovery" processes were also quite applicable to wastes in these subcategories. In addition, many D002 wastes also are hazardous for other reasons and may require that treatment processes in addition to neutralization, incineration, or recovery be employed. For example, a facility may have interpreted that biodegradation would have been precluded from use for a D002 waste that also contained organics. Since biodegradation may have actually been a technically viable alternative for this waste, the facility would have had to submit a petition for a treatability variance. While the Agency probably would have granted it, the variance process would have created an unnecessary burden on both the regulatory and regulated community, and probably without incurring any additional protection of human health and the environment.

As a result, EPA is promulgating a general treatment standard for wastes in the D002 Acid and Alkaline Subcategories that allows the use of any appropriate treatment technology, namely, "Deactivation (DEACT) to Remove the Characteristic of Corrosivity." This means that the facility may use any treatment (including neutralization achieved through mixing with other wastewaters) that results in a pH above 2 but less than 12.5 and thereby removes the characteristic of corrosivity. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a technical description of the technologies referred to by a five-letter technology code in parentheses.

By establishing this treatment standard, the Agency believes that a variance from this standard could be considered for D002 wastes that cannot be effectively treated to meet the standard (40 CFR 268.44). Such a situation could occur for small quantities of corrosive materials containing extremely toxic or otherwise hazardous chemicals that may cause an unnecessary risk during treatment.

The Agency is aware that regulations were promulgated for liquid wastes having a pH of less than or equal to 2.0 in the California List final rule (52 FR 25760) by codifying the statutory level of pH greater than 2.0 into 40 CFR 268.32. This rulemaking, however, is not adequate to address the universe of D002 wastes. The California List restrictions apply only to liquid "acidic corrosive wastes," without specifically identifying them as D002 wastes. Furthermore, the California List final rule did not specify a pH adjustment as a required treatment standard; in fact, the waste may be merely rendered nonliquid prior to land disposal and still satisfy the California List requirements. Therefore, the Agency is promulgating treatment standards for D002 wastes that will supersede the California List regulations because these standards are more specific.

This background document does not specifically address corrosive solids in the Acid or Alkaline Subcategory because there is not a definition of corrosive solids in 40 CFR 261.22(a)(1) at this time. Until the Agency amends 40 CFR 261.22(a)(1) to include a definition for corrosive solids and promulgates a treatment technology, generators must prudently handle wastes with regard to known hazards. Although not required under current regulations, many generators of corrosive solids prefer to classify these wastes as D002 corrosives and choose waste management and disposal protocols accordingly in an added effort to protect the environment.

3.4.2 Other Corrosives Subcategory

The physical and chemical characteristics of this group of wastes vary greatly. The wastes may be aqueous or they may be primarily organic. Corrosive solids may also be classified in this subcategory. In addition, a large variety of corrosive chemicals may appear as constituents in this type of corrosive waste. Depending on the concentration of these corrosive chemicals, they may corrode SAE 2010 steel.

Wastes in the Other Corrosives Subcategory are often treated by deactivating the corrosive constituents of the waste with an appropriate chemical reagent. Wastes that contain high concentrations of corrosive organics are often incinerated; however, because of the great variety of potential corrosive organics, the Agency does not believe that it should establish concentration-based standards based on incineration for these D002 wastes. Removal and recovery of either organic or inorganic corrosive constituents may also be applicable technologies since recovery could extract the corrosive constituents until the waste itself is no longer corrosive to steel.

EPA believes that a flexible standard is appropriate for wastes in the D002 Other Corrosive Subcategory and is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Corrosivity." See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses. This standard will allow the use of the "best" treatment based on the chemical and physical characteristics of the waste.

The Agency believes that this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., the corrosivity to steel may cause rupture of a tank or container, thus releasing the contents either suddenly or through leaks), rather than on other criteria such as levels of hazardous constituents. Additionally, by establishing this standard, the Agency believes that a variance from it could then be considered for D002 wastes that could not be effectively deactivated.

Table 3-2 BDAT Treatment Standards for D002

ACID SUBCATEGORY
261.22(a)(1)

DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC
OF CORROSIVITY*

ALKALINE SUBCATEGORY
261.22(a)(1)

DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC
OF CORROSIVITY*

OTHER CORROSIVES SUBCATETORY
261.22(a)2

DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC
OF CORROSIVITY*

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* See 40 CFR 268 Appendix VI for a list of applicable technologies that can be used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies indicated by a five-letter technology code in parentheses.

4. CHARACTERISTIC REACTIVE WASTES (D003)

According to 40 CFR 261.23(a), there are eight criteria for defining a waste as a D003 Reactive Waste. Paraphrasing these criteria, a waste can be a D003 waste if (1) it is unstable and readily undergoes violent changes without detonating; (2) it reacts violently with water; (3) it forms potentially explosive mixtures with water; (4) when mixed with water, it generates toxic gases; (5) it is a cyanide- or sulfide-bearing waste that, under certain conditions, can generate toxic gases; (6) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement; (7) it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure; or (8) it is a forbidden explosive, a Class A explosive, or a Class B explosive.

EPA determined that these eight criteria translated directly into five treatability groups for D003 wastes. The first treatability group is classified as the Reactive Cyanides Subcategory and refers to those D003 wastes that exhibit the properties listed in 40 CFR 261.23(a)(5) for cyanide. The second treatability group is classified as the Explosives Subcategory and refers to those D003 wastes that exhibit the properties listed in 40 CFR 261.23(a)(6) through 261.23(a)(8). The third treatability group is classified as the Water Reactives Subcategory and refers to those D003 wastes that exhibit the properties listed in 40 CFR 261.23(a)(2) through 262.23(a)(4). The fourth treatability group is classified as the Reactive Sulfides Subcategory and refers to those D003 wastes that exhibit the properties listed in 40 CFR 261.23(a)(5) for sulfide. The fifth treatability group is classified as the Other Reactives Subcategory and refers to those D003 wastes that exhibit the properties listed in 40 CFR 261.23(a)(1).

4.1 Waste Characterization

The Agency realizes that the compositions of D003 wastes can vary significantly; hence, the Agency will not attempt to characterize every D003 waste stream that can be generated. Consequently, the Agency bases its BDAT development on a generalization of characteristics for each of the five subcategories listed previously. Tables D-1 and D-2 in Appendix D present some characterization for the RCRA-permitted facilities that generate D003 and D003 wastes mixed with other RCRA-listed and characteristic wastes, respectively.

4.1.1 Reactive Cyanides Subcategory

D003 wastes in the Reactive Cyanides Subcategory are, by definition, those cyanide-bearing wastes that generate toxic gases (assumed to be hydrogen cyanide) when exposed to pH conditions between 2 and 12.5 in a sufficient quantity to present a danger to human health and the environment. EPA's approved analytical procedures can be found in SW-846 Volume 1C, Chapter 7 (USEPA 1986b), which defines the characteristic and regulation of reactive wastes. Specifically, Section 7.3.3.2 describes the "test method to determine hydrogen cyanide released from wastes," which outlines the correct procedure of hydrogen cyanide gas liberation from reactive wastes. Method 9010 is the analytical method for quantitatively determining reactive cyanide concentrations.

The majority (by volume) of all D003 wastes that are generated can be identified as belonging to the Reactive Cyanides Subcategory. These are typically solid cyanide compounds from plating operations and rinse waters from electroplating or heat treating. The data in Table D-3 in Appendix D show that the nonwastewaters can contain concentrations up to 70 percent cyanide and the wastewaters can contain up to 720 ppm cyanide.

4.1.2 Explosives Subcategory

D003 wastes in the Explosives Subcategory are, by definition, those wastes that are (1) capable of detonation or explosive reaction if subjected to a strong initiating source; (2) if heated under confinement, readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure; or (3) a forbidden explosive as defined in 49 CFR 173.51, a Class A explosive as defined in 49 CFR 173.53, or a Class B explosive as defined in 49 CFR 173.88. These definitions, as presented in 49 CFR Part 173, can be found in Appendix E of this document. The Agency has chosen to rely on the current descriptive definition of D003 explosive wastes primarily because the available tests for measuring the various classes of wastes embraced by the reactivity definition suffer from some deficiencies.

While these wastes are not generated as frequently as the reactive cyanides, they are generated more often than all other reactive subcategories. The available characterization data for this subcategory are shown on Tables D-4 and D-5 in Appendix D. These data show wastes containing nitrocellulose, ethyl centralite, isomers of TNT, nitroglycerin, and other explosive compounds. Most of these wastes in the Explosive Subcategory appear to be solids.

4.1.3 Water Reactives Subcategory

D003 wastes in the Water Reactives Subcategory can be either organic or inorganic in nature. All of these wastes (1) react violently with water; (2) form potentially explosive mixtures with water; or (3) when mixed with water, generate toxic gases, vapors, or fumes in a quantity sufficient to present a danger to human health or the environment. These wastes are generated on a sporadic basis and generally in low volumes.

Wastes believed to be in the Water Reactive Subcategory are shown in Table D-6 in Appendix D. Wastes in the Water Reactives Subcategory include waste batteries (probably lithium), slags generated by the gray iron foundries industry, and scrap alkali metals. Additionally, wastes containing benzalchloride are water reactive. Benzotrichloride exists as an unstable liquid that fumes in air and hydrolyzes in the presence of moisture, forming benzoic and hydrochloric acids.

4.1.4 Reactive Sulfides Subcategory

D003 wastes in the Reactive Sulfides Subcategory are, by definition, those sulfide-bearing wastes that generate toxic gases (assumed to be H_2S) when exposed to pH conditions between 2 and 12.5 in a sufficient quantity to present a danger to human health and the environment. Currently, the accepted method for quantitatively determining reactive sulfides is outlined in SW-846, Volume 1C, Section 7.3.3.2 and in Method 9030 (USEPA 1986b). The Agency believes that some of these wastes may be contaminated with organic sulfides such as mercaptans. The data in Table D-7 in Appendix D show that petroleum wastes can contain up to 60 percent sulfides. These wastes are by BDAT definition nonwastewaters. The wastewaters can contain up to 4.3 percent sulfides.

4.1.5 Other Reactives Subcategory

D003 wastes in the Other Reactives Subcategory are wastes that are normally unstable and readily undergo violent change without detonating. These wastes may be either organic or inorganic. Information suggests that these wastes are infrequently generated and probably in small quantities. The data in Table D-8 in Appendix D show characterization data for wastes believed to be in the D003 Other Reactives Subcategory. Most of these wastes are reactive or polymerizable organics generated during halogenation and may contain fluorine.

4.2 Industries Affected

Because of the diversity of industries generating D003 wastes, the Agency will not describe every industry that generates characteristic reactive wastes. Tables D-1 and D-2 in Appendix D present industry descriptions of the RCRA-permitted facilities that generated D003 wastes and D003 mixed wastes, respectively. The approximate volumes produced and the current waste management practices are also included on both tables. This information has been gathered from the 1986 EPA TSDR Survey (USEPA 1986a). Confidential business information (CBI) is not included. The following are brief summaries describing by subcategory the industries that will be affected by the land disposal ban of D003 wastes.

4.2.1 Reactive Cyanides Subcategory

As stated in the waste characterization section, the majority of all D003 wastes generated can be identified as belonging to the Reactive Cyanides Subcategory. These D003 wastes typically have been identified as being generated by the electroplating and metal finishing industries and include mixed cyanide salts, cyanide solutions, and cyanide-bearing sludges.

4.2.2 Explosives Subcategory

These wastes typically have been identified as being generated by the explosives industry during the production of ammunition, by the space industry during the production of rocket fuels, and by the U.S. Department of Defense. The medical industry also generates an explosive waste possibly containing nitroglycerin, since this compound is used in heart medicine.

4.2.3 Water Reactives Subcategory

The generators of wastes in this subcategory are primarily those industries using or producing alkali metals, for example, the chemicals industry and a few segments of the nonferrous metals industry. Other generators include facilities discarding lithium batteries. The organic chemicals industry also generates wastes containing benzalchloride.

4.2.4 Reactive Sulfides Subcategory

Industries generating wastes containing reactive sulfides include the industrial organic chemicals industry during "cleanout of equipment," the petroleum industry during "cleanout of production processes," and the inorganic chemicals industry during "filtration/centrifuging" processes.

4.2.5 Other Reactives Subcategory

The Agency has limited information concerning wastes in this subcategory. It is believed that most wastes in the Other Reactives Subcategory are generated mainly by the organic chemicals industry during halogenation processes.

4.3 Applicable/Demonstrated Technologies

This section describes the applicable and demonstrated treatment technologies pertinent to the treatment of D003 wastes and current management practices for these wastes. To be applicable, a technology must theoretically be usable to treat the waste in question or a similar waste. To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or of a similar waste.

Most generators of D003 wastes are currently performing some form of treatment. The reason for this is that reactive wastes are already restricted from placement in surface impoundments, waste piles, land treatment units, and landfills according to 40 CFR 264.229, 264.256, 264.281, and 264.312, respectively. The following paragraph is paraphrased from the CFR for disposal requirements for reactive wastes:

> Reactive waste must not be placed in a surface impoundment, waste pile, land treatment unit, or landfill, unless the following conditions are met: (1) the waste is treated, rendered, or mixed before or immediately after placement in the impoundment so that the resulting waste, mixture, or dissolution of material no longer meets the definition of reactive waste; (2) the owner or operator of a facility that treats, stores, or disposes of reactive waste takes precautions to prevent reactions that generate extreme heat or pressure, fire or explosions, or violent reactions; produce uncontrolled toxic mists, fumes, dusts, or gases in sufficient quantities to threaten human health or the environment; produce uncontrolled flammable fumes or gases in sufficient quantities to pose a risk of fire or explosions; damage the structural integrity of the device or facility; or threaten human health or the environment through other like means; (3) the waste is managed in such a way that it is protected from any material or conditions that may cause it to ignite or react.

4.3.1 Reactive Cyanides Subcategory

Reactive cyanide wastes are already restricted from disposal in landfills under existing regulations of wastes containing reactive listing constituents. Under the California List restrictions, the statute already prohibits liquid wastes having free cyanide concentrations in excess of 1,000 mg/kg (ppm) from being land disposed, as codified in 40 CFR 268.31. However, these restrictions refer to these wastes only as "cyanide wastes" without specifically identifying them as D003 wastes or any of the other wastes listed for their cyanide content. The statutory restriction did not specify any treatment technology, nor did it establish the 1,000 mg/kg as a "treatment standard." While these liquid reactive cyanide wastes are not typically placed in most types of land disposal units, it is possible that some have been or are being placed in surface impoundments. Technologies considered to be applicable/demonstrated to treat wastes in the Reactive Cyanides Subcategory are those technologies that destroy the cyanide in the waste.

EPA has identified six technologies as potentially applicable for treatment of cyanides in both wastewaters and nonwastewaters: (1) electrolytic oxidation; (2) chemical oxidation with several oxidizing agents, such as hypochlorite or chlorine (alkaline chlorination), permanganate, ozone, or SO_2/air (Inco process); (3) wet air oxidation; (4) high temperature cyanide hydrolysis; and (5) incineration. The first four technologies are most effective in treatment of cyanide in wastes that contain primarily dissolved or soluble cyanide salts, but are also applicable to treatment of wastewater treatment sludges and other solids that contain treatable concentrations of cyanide. Incineration is applicable to nonwastewater forms of the wastes.

Electrolytic oxidation followed by alkaline chlorination, chemical oxidation (alkaline chlorination or other methods) alone, electrolytic oxidation alone, wet air oxidation, and high temperature hydrolysis reduce the concentration of cyanide in the wastewaters or nonwastewaters treated. These technologies fully destroy the amenable cyanide present in the waste but treat the complexed cyanides to varying degrees, depending on, among other things, the stability of the metal-cyanide complex and the severity of the oxidizing agent and reaction conditions. Iron cyanide complexes are typically the most resistant to oxidation treatment.

EPA has identified incineration as an applicable technology for treatment of cyanide in wastes containing high concentrations of organics. Incineration is a thermal treatment process that destroys the organic and oxidizable inorganic waste constituents. Incineration of this waste generates an ash and a scrubber water that may require further treatment for metallic constituents if present.

Available information shows that electrolytic oxidation followed by alkaline chlorination, alkaline chlorination alone, wet air oxidation, high temperature hydrolysis, SO_2/air oxidation, and incineration demonstrated for treatment of concentrated cyanide-containing wastes. The Agency believes that most D003 Reactive Cyanides are already being treated by alkaline chlorination or electrolytic oxidation. They typically contain high concentrations of the cyanide compounds. Many oxidation/reduction technologies, such as alkaline chlorination or electrolytic oxidation, are believed to be able to lower the concentration of cyanide so that the waste will not contain reactive levels of cyanides, thereby removing the hazardous characteristic.

4.3.2 Explosives Subcategory

The Agency has identified chemical oxidation/reduction and incineration as applicable methods of treatment. These processes permanently remove the explosive characteristic of D003 waste permanently by thermal or chemical destruction of explosive constituents.

Incineration is a technology that destroys the organic constituents in the waste by converting them to carbon dioxide, water, and other combustion products. Incineration may result in residuals that may require treatment because of their metal content. Specifically, the residuals consist of ash and scrubber water. Incineration of highly explosive constituents may require treatment in units that are specially designed and fitted with certain explosion-proof equipment. These types of units are not typically found at commercial incineration facilities. The Agency is aware that these types of units are currently used for many of the DOD explosive wastes.

Improper management of the ash/residue generated from the treatment of explosive wastes may result in environmental contamination through the air, soil, and subsurface and surface water pathways. For example, the ash generated from thermal treament must be sampled to determine whether it is a hazardous waste through the use of the reactivity and EP toxicity analyses. The Department of Defense (DOD) community typically uses the Bureau of Mines gap test and the detonation deflagration transition test to determine whether a sample is reactive (Department of the Army 1987); however, there is no approved EPA method.

Additionally, the thermal treatment of some reactive hazardous wastes may generate residues that may contain nitrates and perchlorates in concentrations high enough to qualify as oxidizers as defined in 49 CFR 173.151. In that case, these residues would be ignitable hazardous wastes (D001). This oxidizer determination would be necessary only when wastes that could possibly generate oxidizers are thermally treated.

While these explosive wastes are not typically placed in most types of land disposal units, it was common practice to thermally treat (i.e., incinerate) these wastes. In fact, the Agency believes that most D003 wastes in the Explosives Subcategory are currently thermally treated (i.e., incineration in specially designed units) hence, this technology is demonstrated. The Agency also received information indicating that typical RCRA commercial incinerators are capable of safely treating certain D003 explosive wastes. Therefore, this technology is also demonstrated.

The Agency has information indicating that chemical oxidation/reduction technologies are being used to effectively treat certain D003 explosive wastes. Based on this information, the Agency considers chemical oxidation/reduction to also be demonstrated.

4.3.3 Water Reactives Subcategory

Because of their violent reactivity with water, these wastes are not typically placed in land disposal units and certainly are not generally placed in surface impoundments. Applicable treatment technologies for these wastes would be thermal oxidation/reduction (i.e., incineration) to react the wastes with water (hydrolysis under controlled conditions) and chemical oxidation/reduction. The most common treatment for these wastes is actually controlled reaction with water and neutralization of the acid or alkali solution generated. Less common methods are thermal and chemical oxidation/reduction. During chemical or thermal oxidation/reduction, the reactive organic constituents are deactivated by the explosion and the reactive inorganic constituents form less hazardous oxides.

The Agency has information indicating that several facilities are treating water reactive wastes with the deactivation technologies described above. Consequently, the Agency believes that these technologies are demonstrated to treat water reactive wastes.

4.3.4 Reactive Sulfides Subcategory

Applicable treatment for sulfide wastes would be to chemically convert the reactive sulfides to sulfur, to insoluble metallic sulfide salts, or to insoluble sulfates that can be removed or recovered. Some data indicate that these wastes can be treated by alkaline chlorination, incineration, or chemical deactivation techniques. The Agency has information indicating that at least one facility is using alkaline chlorination and at least one facility is using incineration to treat D003 Reactive Sulfides hence, both technologies are demonstrated. In some instances, the D003 may be in a form amenable to recovery of sulfur by sulfuric acid production from incineration of stack gases. The Agency knows of one facility currently burning D003 Reactive Sulfide Wastes in an incinerator with a scrubber to produce sulfuric acid.

The Agency believes that some of these wastes may also be contaminated with organic sulfides known as mercaptans. These malodorous chemicals are believed to complicate the treatment of these reactive sulfide wastes. The Agency has information indicating that mercaptans can be oxidized to sulfates and the corresponding acid using chlorine dioxide (McGlathery 1989). Also, EPA received data demonstrating that treatment with chlorine dioxide is an effective technology for destroying organic sulfides and mercaptans in petroleum wastes. The Agency reviewed stabilization data indicating that this treatment process can treat D003 reactive sulfide waste by removing the characteristic. EPA knows of several facilities that are using mercaptan-free and organic-free sulfide wastes to precipitate metals from wastewaters. Another facility uses a thermal process that converts sulfides to sulfates instead of sulfur oxides. Consequently, EPA believes that these technologies are demonstrated to treat D003 sulfide reactive wastes.

4.3.5 Other Reactives Subcategory

The Agency suspects that while these wastes may be generated, it is unlikely that they would require placement in any type of land disposal unit. In general, the Agency believes that these unstable wastes can be deactivated using either thermal oxidation/reduction reactions with water or chemical oxidation/reduction (i.e., controlled reaction with water). The Agency has information indicating that one facility is using "heat treatment of a reactive flucrocarbon contaminated wastewater" to deactivate a waste believed to belong in this subcategory. As a result, the Agency believes that deactivation technologies are demonstrated to treat wastes in the Other Reactives Subcategory.

4.4 Identification of Best Demonstrated Available Technology (BDAT)

The Agency believes that there are two major options for evaluating potential standards for each D003 characteristic waste subcategory. The first option is for EPA to promulgate numerical treatment standards. However, for all subcategories of D003 wastes except the reactive cyanides, the Agency believes that development of any numerical treatment standards, based on any of the appropriate deactivation techniques, would be difficult because there is no known analytical test designed to measure the reactivity for these wastes, nor is there a test that distinguishes the reactive chemical from the deactivated chemical (e.g., sodium). The second option is to promulgate a method or sequence of methods of treatment as BDAT. Table 4-1 at the end of this section presents the treatment standards being promulgated for all subcategories of D003.

All of the known treatment processes for the five subcategories of D003 Reactive Wastes can result in significant amounts of solid residues. These residues may or may not exhibit the characteristic of EP toxicity for metals. Instead of trying to establish metal standards for these residues, the Agency prefers to regulate land disposal of them only if they appear to be EP toxic wastes. Thus, the Agency is currently not promulgating standards for metals in the residues from the deactivation of D003 wastes.

It is important to note that management practices have already been established for reactive wastes in surface impoundments, waste piles, land treatment units, and landfills (see 40 CFR 264.229, 265.256, 264.281, and 264.312, as well as 265.229, 265.256, 265.281, and 265.312). The treatment standards being promulgated for reactive (D003) wastes will supersede the above-mentioned provisions and exclusions for permissible land disposal of these wastes outlined in Parts 264 and 265. Facilities handling reactive wastes will have to comply with the promulgated treatment standards for these wastes in order to land dispose them.

The Agency is superseding the 40 CFR Parts 264 and 265 sections referenced above to avoid potential conflicts between these promulgated treatment standards and existing land disposal provisions for D003 wastes. The Agency believes that protection of human health and the environment will be better accomplished since compliance with the treatment standards will render these wastes nonhazardous by permanently eliminating the characteristic (reactivity).

4.4.1 Reactive Cyanides Subcategory

The Agency has treatment performance data for treatment of cyanides. The Agency is establishing a concentration-based treatment level for wastes in the D003 Reactive Cyanide Subcategory rather than establishing a standard of "Deactivation (DEACT) to Remove the Characteristic of Reactivity" for the following reasons. First, unlike the other characteristic wastes, the Agency can identify an indicator compound (i.e., cyanide) that is known to be present in all D003 reactive cyanide wastes and can analyze the indicator compound in wastewater and nonwastewater matrices with EPA-approved SW-846 analytical test methods. Second, EPA believes most D003 cyanide wastes are generated from the same types of processes that generate the F006-F012 and P030 wastes and, thus, are frequently of the same type, and present similar risks when land disposed, as the listed wastes. EPA does not believe that Congress precluded the Agency from establishing the same treatment standards for the D003 wastes that have been established for the listed wastes (assuming, of course, that such standards are consistent with the mandate of Section 3004(m) to reduce toxicity or mobility so that risks to health and the environment are minimized). Finally, the Agency suspects that some generators are currently misclassifying F006-F012 and P030 wastes as D003 reactive cyanide wastes. While this is primarily an issue for enforcement, the Agency is concerned that a less stringent standard would discourage proper identification of the F and P cyanide wastes.

The Agency believes that simple cyanides (e.g., NaCN, KCN) are more likely to react to liberate hydrogen cyanide gas since they are soluble and have weaker bond energies than complex cyanides (e.g., $Fe_3[Fe(CN)_6]^2$, $Ni[Fe(CN)]^2$, Zn2Fe(CN)6). Consequently, EPA believes that simple (soluble) cyanide rather than complex cyanide is the cyanide form most likely to give a waste containing cyanide the characteristic of reactivity. However, the Agency reviewed data indicating that some D003 reactive cyanide nonwastewaters contain a wide variety of cyanide compounds as well as other constituents that affect the ultimate treatability of the total cyanide (see Appendix F). Some of these wastes contain sufficient iron content to result in iron cyanide complex formation, even for wastes that are predominantly reactive (soluble) cyanide and are identified only as D003. Statements from generators of D003 cyanide waste streams indicate that their wastes are unavoidably contaminated with iron during their manufacturing processes and that a threshold level of only 50 to 100 mg/kg iron is required to result in formation of iron cyanide complexes.

During the Agency's review of the characterization data for D003 cyanide wastes, a surrogate (i.e., iron concentration) in the untreated waste was used as a means of estimating the presence of complex cyanides. EPA notes, however, that all of the iron in an untreated waste may not bond with the cyanides to form complex iron cyanides. The characterization data show that D003 cyanide wastes can contain total iron concentrations averaging 7,000 mg/kg and total cyanide concentrations averaging 40,000 mg/kg. The waste characterization data for D003 cyanide wastes is included as Appendix F. The characterization data for the complex cyanide-containing wastes (i.e., F006-F009) show iron concentrations averaging 5,000 mg/kg and total cyanide concentrations averaging 30,000 mg/kg. The characterization data for the simple cyanide-containing wastes (i.e., F011, F012, and P030) show iron concentrations averaging 20 mg/kg and total cyanide concentrations averaging 3,000 mg/kg.

Based on the high iron contents shown to be present in some D003 cyanide wastes, the Agency believes that some D003 cyanide wastes may contain complexed cyanides and thus may not be treatable to the 110 mg/kg level. The vast majority of characterization data reviewed by the Agency indicate that D003 nonwastewaters more closely resemble the F006-F009 nonwastewaters instead of the F011, F012, and P030 nonwastewaters. Therefore, the Agency is promulgating treatment standards of 590 mg/kg total cyanide and 30 mg/kg amenable cyanide based on the treatment of wastes containing complex cyanides (i.e., F006-F009 nonwastewaters) for nonwastewaters in the D003 Reactive Cyanide Subcategory. Detailed information on the development of these treatment standards can be found in the BDAT background document for cyanide wastes (USEPA 1988b).

For the wastewaters in the D003 Reactive Cyanide Subcategory, EPA considered a treatment standard of 1.9 mg/l total cyanide and 0.1 mg/l amenable cyanide based on alkaline chlorination. Comments and data were received from Sterling Chemicals demonstrating that alkaline chlorination did not achieve those limits for D003. Further examination of categorical wastewater discharge standards, pursuant to the Clean Water Act, supported the inability of alkaline chlorination to achieve the proposed amenable cyanide level. EPA is promulgating an amenable cyanide standard of 0.86 mg/l based on the Metal Finishing categorical wastewater discharge standards. Data submitted by Sterling Chemicals demonstrated compliance with this limit. With regard to total cyanide, the Agency is reserving the standard for further analyses to resolve the substantial variation in total cyanide levels submitted by commenters and standards established for categorical wastewater discharges. In the interim, the amenable cyanide limit will ensure that alkaline chlorination or equivalent BDAT technology is utilized to comply with the land disposal restriction for reactive cyanide wastes.

4.4.2 **Explosives Subcategory**

The Agency believes that most D003 wastes that are generated in the Explosives Subcategory are currently being treated by chemical deactivation or incineration in specially designed units. These processes are used because they remove the explosive characteristic of the D003 waste.

Because of the large number of explosive formulations and the difference in applicable treatments (Department of the Army 1984), the Agency believes that a standard of "Deactivation" is appropriate for wastes in this group. This standard would allow the regulated community the ability to use the treatment technology (i.e., incineration, chemical deactivation) that best fits the type of explosive waste requiring treatment. The Agency believes this approach is applicable for these wastes since the hazardous characteristic is based on an imminent hazard (i.e., explosivity) rather than on other criteria such as levels of hazardous constituents, and that technologies exist that can completely remove this characteristic.

Furthermore, by establishing this as a treatment standard, the Agency believes that the variance procedures could be used as a method of providing a more complete evaluation of the safety hazards associated with each individual deactivation procedure at each facility. This may be the preferred approach in that (1) it appears to provide more assurance of the protection of human health and the environment at each individual site by providing a more extensive technical evaluation by regulatory personnel; (2) it allows the wastes to be treated by any treatment technology that may be developed (such as specially designed incineration units); and (3) it also bans most forms of land disposal.

The Agency is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Reactivity" for nonwastewaters and wastewaters in the D003 Explosive Subcategory. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five letter technology code in parentheses. This standard should provide the treaters of explosive wastes the ability to use the "best" treatment technology based on the chemical and physical parameters of the explosive waste, and any safety considerations.

The Agency has information indicating that mixing with water or organic liquids (e.g., kerosene) may be necessary in some cases to reduce the potential for explosion and thus ensure safe handling and/or transportation for subsequent incineration or chemical treatment of explosive wastes. EPA is not restricting the use of this practice for any waste in the D003 Explosives Subcategory.

4.4.3 Water Reactives Subcategory

Because of the diversity in physical and chemical forms of the waste in this subcategory, it is not possible to determine a "best" technology for all wastes. The Agency is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Reactivity" for wastes in the D003 Water Reactives Subcategory to allow flexability in the selection of the "best" technology. The Agency believes that this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (i.e., potential violent reaction with water) rather than on other criteria such as levels of hazardous constituents and since technologies exist that can completely remove these characteristics. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses. For wastes in the D003 Water Reactives Subcategory, the standard is established only for nonwastewaters since these wastes are very reactive with water and thus cannot exist as wastewaters.

Furthermore, by establishing this treatment standard, the Agency believed that the variance procedures could be used as a method of providing a more complete evaluation of the safety hazards associated with each individual deactivation procedure at each facility. This may be the preferred approach in that (1) it appears to provide more assurance of the protection of human health and the environment at each site by providing a more extensive technical evaluation by regulatory personnel; (2) it allows the wastes to be treated by any treatment technology that may be developed (such as controlled hydrolysis); and (3) it also bans most forms of land disposal.

Several commenters have indicated that mixing with certain organic liquids (such as kerosene) may be necessary in some cases to reduce the potential for violent reaction with water and thus ensure safe handling and/or transportation for subsequent incineration or chemical treatment. EPA is not restricting the use of this practice for any waste in this D003 subcategory.

4.4.4 Reactive Sulfides Subcategory

The Agency is in the process of developing a quantitative threshold for toxic gas generation for reactive sulfide wastes. The interim value the Agency is considering is 500 milligrams of hydrogen sulfide generated per kilogram of waste (Claussen). Since the Agency has not yet approved a standard analytical method for testing either sulfides or reactive sulfides in hazardous wastes or in nonwastewater treatment residues, the Agency is unable to promulgate a numerical treatment standard for D003 wastes in this subcategory at this time. However, it may develop a method and establish numerical standards for wastes in this group in the future.

The Agency determined that a wide variety of treatment processes are currently used to treat reactive sulfide wastes. Therefore, the Agency is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Reactivity" for nonwastewaters and wastewaters in the D003 Reactive Sulfides Subcategory to allow the treatment facility the flexibility to use the "best" technology for the particular waste stream. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies as referred to by a five-letter technology code in parentheses.

4.4.5 Other Reactives Subcategory

The Agency is promulgating a standard of "Deactivation" for D003 wastes in the Other Reactives Subcategory. The Agency believed that this is an appropriate approach for these wastes since the hazardous characteristic is based on imminent hazard (e.g., violent reactions) rather than on other criteria such as levels of hazardous constituents and since technologies exist that can completely remove these characterics.

Furthermore, by establishing this treatment standard, the Agency believes that the variance procedures could be used as a method of providing a more complete evaluation of the safety hazards associated with each deactivation procedure at each facility. This may be the preferred approach in that (1) it appears to provide more assurance of the protection of human health and the environment at each site by providing a more extensive technical evaluation by regulatory personnel; (2) it allows the wastes to be treated by any treatment technology that may be developed; and (3) it also bans most forms of land disposal.

Because of the diversity in physical and chemical forms of the waste in this subcategory, it is not possible to determine a "best" technology for all wastes. The Agency is promulgating a treatment standard of "Deactivation (DEACT) to Remove the Characteristic of Reactivity" for nonwastewaters and wastewaters in the D003 Other Reactives Subcategory to allow flexibility in the selection of the "best" technology. See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

Several commenters have indicated that mixing with certain organic liquids (such as kerosene) may be necessary in some cases to reduce the potential for violent reaction with water and thus ensure safe handling and/or transportation for subsequent incineration or chemical treatment. EPA is not restricting the use of this practice for any waste in this D003 subcategory.

Table 4-1 BDAT Treatment STandards for D003

REACTIVE CYANIDES SUBCATEGORY
261.23(a)(5)
[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/kg)
Cyanides (Total)	590
Cyanides (Amenable)	30

REACTIVE CYANIDES SUBCATEGORY
261.23(a)(5)
[Wastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/l)
Cyanides (Total)	Reserved
Cyanides (Amenable)	0.86

Table 4-1 (continued)

REACTIVE SULFIDES SUBCATEGORY 261.23(a)(5)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

EXPLOSIVES SUBCATEGORY 261.23(a)(6), (7), AND (8)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

WATER REACTIVES SUBCATEGORY 261.23(a)(2), (3), AND (4)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

OTHER REACTIVES SUBCATEGORY 261.23(a)(1)
DEACTIVATION (DEACT) TO REMOVE THE CHARACTERISTIC OF REACTIVITY*

* See 40 CFR 268 Appendix VI for a list of applicable technologies that used alone or in combination can achieve this standard. See also 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

5. P AND U WASTES CONTAINING REACTIVE LISTING CONSTITUENTS

This chapter describes regulations for the RCRA-listed P and U wastes containing reactive listing constituents. These wastes pose a significant risk during handling because of their reactivity. Development of BDAT for P and U wastes containing reactive listing constituents has been added to this document since some of these wastes may be similar to some D003 wastes based on the characteristic of reactivity. The hazardous wastes with hazardous waste codes beginning with P are identified as acute hazardous waste, while the hazardous waste codes beginning with U identify toxic wastes. Whether a waste is an acute hazardous waste or a toxic waste generally has no bearing on the treatability of the waste. The following is a list of P and U wastes containing reactive listing constituents:

P006 - Aluminum phosphide
P009 - Ammonium picrate
P015 - Beryllium dust
P056 - Fluorine
P068 - Methyl hydrazine
P073 - Nickel carbonyl
P081 - Nitroglycerine
P087 - Osmium tetroxide
P096 - Phosphine
P105 - Sodium azide
P112 - Tetranitromethane
P122 - Zinc phosphide (>10%)

U023 - Benzotrichloride
U086 - 1,2-Diethylhydrazine
U096 - a,a-Dimethylbenzylhydroperoxide
U098 - 1,1-Dimethylhydrazine
U099 - 1,2-Dimethylhydrazine
U103 - Dimethyl sulfate
U109 - Diphenylhydrazine
U134 - Hydrogen fluoride
U133 - Hydrazine
U135 - Hydrogen sulfide
U160 - Methyl ethyl ketone peroxide
U189 - Phosphoric sulfide
U249 - Zinc phosphide (<10%)

It should be mentioned that strontium sulfide (P107) was a reactive listing constituent. However, the Agency is not regulating P107 because on October 31, 1988, it was removed from Appendix VIII of Part 261, the list of RCRA hazardous constituents. EPA took this action because strontium sulfide, even when improperly treated, stored, transported, disposed of, or otherwise managed, does not pose a significant hazard to human health or the environment.

However, wastes containing strontium sulfide are not released from regulatory control under RCRA. If a waste contains high concentrations of strontium sulfide, it may exhibit the characteristic of reactivity (40 CFR 261.23(a)(5)); that is, a sulfide-bearing waste that, when exposed to pH conditions between 2 and 12.5, it can generate toxic gases (e.g., H_2S), vapors, or fumes in a quantity sufficient to present a danger to human health or the environment. If the wastes exhibit the characteristic of reactivity, they must be handled as characteristic hazardous wastes in the D003 Reactive Sulfide Subcategory as previously described in this document.

5.1 Waste Characterization

According to 40 CFR 261.33, the P and U codes presented above are essentially commercial chemical products (or intermediates) and become hazardous wastes when they are discarded or are intended to be discarded; when they are mixed with waste oil, used oil, or another material; when they are applied to the land for dust suppression or road treatment; when they are otherwise applied to the land in lieu of their original intended use or when they are contained in products that are applied to the land in lieu of their original intended use; or when, in lieu of their original intended use, they are produced for use as (or as a component of) a fuel, distributed for use as a fuel, or burned as a fuel.

These materials can be present in different forms:

- Any commercial or off-specification commercial chemical product (or intermediate) with any of the above generic names;
- Residues remaining in containers that held any of the above-mentioned products (or intermediates); or
- The residue of contaminated soil, water, or other debris that results when there is a cleanup of a commercial product (or intermediate) or off-specification commercial chemical product (or

intermediate) or manufacturing chemical intermediate having the generic name of any of the above-listed products that had been spilled onto the land or into the water.

Since the Agency could not characterize every P and U waste stream that could possibly be generated, the Agency has based its BDAT development on the characteristics of the applicable pure chemical that was listed. Below are descriptions of the pure chemical elements or compounds. The waste codes are listed next to the chemical names; however, these descriptions may not always be indicative of the different P and U wastes containing the reactive chemicals that could be generated. The chemical structures of each listing constituent are shown in Table G-1 in Appendix G. Where noted, the wastes have been listed for their reactivity. All the wastes react violently in some way, but not all are listed for reactivity. A brief statement about why each waste has been listed is also presented below.

P006 - Aluminum phosphide: This compound exists as dark gray or dark yellow crystals with a cubic zinc blend structure. It must be protected from moist air since it reacts readily to produce phosphine, which is highly toxic. It does not melt or decompose thermally at temperatures up to 1000°C. When water and acid are added to aluminum phosphide, phosphine is produced in quantitative yields. The waste is listed for reactivity and toxicity.

P009 - Ammonium picrate: This compound exists as bright yellow bitter scales or orthorhombic crystals. It explodes easily from heat or shock and is soluble in water at 20°C. The waste is listed for reactivity.

P015 - Beryllium dust: This compound exists as a gray metal with a close-packed hexagonal structure. Beryllium has a melting point of 1287°C and a boiling point of 2500°C. The dust or amalgamated metal reacts with hydrochloric acid dilute sulfuric acid, and dilute nitric acid, and reacts violently with strong bases. In both cases, it causes an evolution of hydrogen. Death may result from short exposure to very low concentrations of the dust or its salts.

P056 - Fluorine: This halogen exists as F_2 in its elemental state and is a pale yellow gas. Fluorine has a melting point of

-219.61°C and a boiling point of -188.13°C. Fluorine is the most reactive nonmetal, and it reacts vigorously with most oxidizable substances at room temperature, frequently with ignition. Its violent reactions with organic compounds usually disintegrate the metal. This gas is dangerous to inhale.

P068 - Methyl hydrazine: This compound exists as a clear liquid with an odor that is characteristic of short chain, organic amines. It has a flash point of 70°C and an ignition temperature of 196°C. The vapors may explode and self-ignite in and on contact with oxidizing agents. The chemical is soluble in hydrocarbons. Methyl hydrazine is considered a mild alkaline base and a strong reducing agent. It ignites spontaneously on contact with strong oxidizing agents such as fluorine, chlorine trifluoride, nitrogen tetroxide, and fuming nitric acid.

P073 - Nickel carbonyl: This chemical is a colorless, volatile liquid at standard temperature and pressure. It is extremely poisonous. It oxidizes in the air and explodes at about 60°C. Nickel carbonyl is made by passing carbon monoxide over finely divided nickel.

P081 - Nitroglycerin: This chemical exists as a pale yellow, oily liquid that explodes on rapid heating or on concussion. It crystallizes in two forms and begins to decompose at 50° to 60°C. Nitroglycerin is appreciably volatile at 100°C, evolves nitrous yellow vapors at 135°C, and explodes at 281°C. On explosion, harmless gases (i.e., oxygen, nitrogen, carbon dioxide) are produced. The waste is listed for reactivity and toxicity.

P087 - Osmium tetroxide: The form of this compound is a pale yellow solid. It exists as monoclinic crystals. Osmium tetroxide has a boiling point of 130°C and begins to sublime and distill well below the boiling point. It is soluble in benzene. The vapor is extremely poisonous. This compound is a strong oxidant.

P096 - Phosphine: This chemical compound is a poisonous gas at standard temperature and pressure. It is prepared from white phosphorus and aqueous alkali hydroxide and also by treatment of PH_4I with KOH. This gas is spontaneously flammable in air if there is a trace of P_2H_4 present and burns with a luminous flame. Phosphine is slightly soluble in water and combines violently with oxygen and the halogens. It liberates hydrogen and forms the phosphide when passed over heated metal and forms phosphonium salts when brought into contact with the halogen acids.

P105 - Sodium azide: This compound exists as crystals that decompose into sodium and nitrogen when heated. It is soluble in water at 10°C and in alcohol at 25°C. Sodium azide can react with lead and its compounds to form explosive chemicals.

P112 - Tetranitromethane: This compound exists as a pale yellow liquid. It is insoluble in water and freely soluble in alcohol. It attacks iron, copper, brass, zinc, and rubber. Tetranitromethane can be decomposed by an alcoholic solution of potassium hydroxide. It is used as a powerful oxidizing agent. It has a boiling point of 126°C and is highly explosive in the presence of impurities. The waste is listed for reactivity.

P122 - Zinc phosphide: The chemical exists as dark gray, tetragonal crystals and powder. The chemical has a faint phosphorus odor. When heated with the exclusion of air, it melts and finally sublimes. The melting point has been given as 420°C and the boiling point as 1100°C. When kept dry, it is quite stable. It is insoluble in water and alcohol, but soluble in benzene and carbon disulfide, causing the evolution of spontaneously flammable phosphine. It reacts violently with concentrated sulfuric acid and other oxidizing agents. The waste is listed for reactivity and toxicity.

U023 - Benzotrichloride: Benzotrichloride exists as an unstable liquid that fumes in air and hydrolyzes in the presence of moisture, forming benzoic and hydrochloric acids. It is insoluble in water but soluble in alcohol, benzene, ether, and many other organic solvents. Its boiling point is 220.8°C. The waste is listed for reactivity, corrosivity, and toxicity.

U086 - 1,2-Diethylhydrazine: This compound is soluble in alcohol and ether. It has a boiling point of 86°C. When heated to decomposition, it emits toxic fumes of NO_x.

U096 - a,a-Dimethylbenzylhydroperoxide: The boiling point of this compound

is 100°F to 101°F. This compound is an oxidizer and is listed as toxic.

U098 - 1,1-Dimethylhydrazine: This compound is a flammable, hygroscopic, mobile liquid that fumes in air and gradually turns yellow. It is corrosive to skin and has a characteristic ammoniacal odor of aliphatic hydrazines. The chemical is miscible with water, causing the evolution of heat. It is also miscible with alcohol, ether, dimethylformamide, and hydrocarbons. Its boiling point is 63.9°C.

U099 - 1,2-Dimethylhydrazine: This chemical fumes in air and gradually turns yellow. It is miscible with water with the evolution of heat. This compound is corrosive to the skin.

U103 - Dimethyl sulfate: This chemical is a colorless, oily liquid with a boiling point of about 188°C with decomposition and a flash point of 182°C. It is extremely hazardous with no warning characteristics (e.g., odor, irritation).

U109 - Diphenylhydrazine: The form of this compound is yellow crystals with a melting point of 34.5°C. It is insoluble in water and freely soluble in alcohol and ether.

U133 - Hydrazine: Hydrazine exists as a colorless, oily liquid that fumes in air. It has a penetrating odor resembling that of ammonia. Hydrazine is a violent poison that causes delayed eye irritation. It burns with violet flame and explodes during distillation if traces of air are present (also affected by ultraviolet light and metal ion catalysts). Its flash point is 126°F (52°C). Hydrazine can be stored for years if sealed in glass and kept in a cool, dark place. It forms salts with inorganic acids. The chemical is a highly polar solvent and powerful reducing agent. It dissolves many inorganic substances and is miscible with water, methyl, ethyl, propyl, and isobutyl alcohols. Hydrazine forms an azeotropic mixture with water. The waste is listed for reactivity and toxicity.

U134 - Hydrogen fluoride: Hydrogen fluoride is a colorless gas that fumes in air. It is listed as highly irritating, corrosive, and poisonous. In aqueous solutions, it is a weak acid. Its boiling point is -56°C.

U135 - Hydrogen sulfide: This chemical is a flammable, poisonous gas with a characteristic odor of rotten eggs that is perceptible in air in a concentration of 0.002 mg/l. It burns in air with a pale blue flame. The ignition temperature is 260°C. Hydrogen sulfide has explosive limits when mixed with air. Water solutions of hydrogen sulfide are not stable; absorbed oxygen causes the formation of elemental sulfur, and the solutions become turbid rapidly. It is soluble in glycerol. In a 50-50 by volume mixture of glycerol and water, the precipitation of sulfur is retarded considerably.

U160 - Methyl ethyl ketone peroxide: This waste is listed for reactivity and toxicity. The chemical will explode when heated and is a strong oxidizer.

U189 - Phosphoric sulfide: This compound exists as light yellow, triclinic crystals with a peculiar odor. It has a melting point of 286°Ψ to 290°C and a boiling point of 513°Ψ to 515°C. This chemical decomposes in water, forming phosphoric acid and hydrogen sulfide. It is soluble in carbon disulfide and in aqueous solutions of alkali hydroxides. It must be kept tightly closed. The waste is listed for reactivity.

U249 - Zinc phosphide: The chemical exists as dark gray tetragonal crystals and powder. The chemical has a faint phosphorus odor. When heated with the exclusion of air, it melts and finally sublimes. The melting point has been given as 420°C and the boiling point as 1100°C. When kept dry, it is quite stable. It is insoluble in water and alcohol but soluble in benzene and carbon disulfide, causing the evolution of spontaneously flammable phosphine. It reacts violently with concentrated sulfuric acid and other oxidizing agents. The waste is listed for reactivity and toxicity.

It should be mentioned that a waste is not necessarily a P waste or a U waste if it contains one or more of the chemicals with a generic name listed in 40 CFR 261.33. In other words, the fact that a waste contains aluminum phosphide does not automatically render the waste P006 hazardous. P and U wastes are limited to commercial products or intermediates or off-specification versions thereof that are spilled, discarded, or intended to be discarded. Thus, a waste containing aluminum phosphide would be a P006 hazardous waste only if some or all of the aluminum phosphide in the waste were a commercial product, intermediate, or off-specification version thereof at some point in its existence prior to its incorporation into the waste. The available characterization data for the P and U wastes containing reactive listing constituents are presented in Table G-2 in Appendix G.

5.2 Industries Affected

The Agency does not intend to describe every industry that generates the P and U wastes containing reactive listing constituents since any industrial facility that produces, uses, stores, and/or transports the chemicals has the potential of generating the waste. Table G-3 in Appendix G presents a description of the RCRA-permitted facilities that generated the above-listed wastes and the approximate volumes produced in

1986. Confidential Business Information (CBI) is not included. The following is a summary of the producers of the chemicals and the generators of the waste. Brief descriptions of the uses of the chemicals are also presented to indicate areas of potential waste generation.

P006 - Aluminum phosphide: There are no listed producers of this chemical in the SRI 1988 edition. One generator in EPA Region IV is listed in the 1986 TSDR Survey.
USE: Source of phosphine; in semiconductor research; as a fumigant.

P009 - Ammonium picrate: One producer located in EPA Region II is listed in SRI; however, the facility is selling all stock that was originally imported and does not manufacture ammonium picrate. No generators of P009 wastes were listed in the 1986 TSDR Survey.
USE: Explosives, fireworks, rocket propellants.

P015 - Beryllium dust: Two mines currently process beryllium ore. Thirteen generators are listed in the TSDR Survey as generating P015 in 1986: one in EPA Region II, two in EPA Region III, two in EPA Region IV, one in EPA Region V, one in EPA Region VI, one in EPA Region VIII, four in EPA Region IX, and one in EPA Region X.
USE: Source of neutrons when bombarded with alpha particles;aAs a neutron reflector and neutron moderator in nuclear reactors; in radio tube parts and aerospace structures; in inertial guidance systems.

P056 - Fluorine: One producer was listed in the SRI 1988 edition. One generator in Region II is listed in the 1986 TSDR Survey.
USE: Powerful fluorinating agent.

P068 - Methyl hydrazine: No producers are listed in SRI 1988 edition. Three generators are listed in the 1986 TSDR Survey: one in EPA Region III, one in EPA Region V, and one in EPA Region VI.
USE: In rocket fuel; intermediate in chemical synthesis.

P073 - Nickel carbonyl: One company located in EPA Region III is listed as a producer in the SRI 1988 edition. One generator in EPA Region III is listed in the 1986 TSDR Survey.
USE: Laboratory and organic synthesis.

P081 - Nitroglycerin: Five U.S. military installations are currently producing this chemical: two in EPA Region II, two in EPA Region III, and one is located in EPA Region VII. No P081 waste

generators are listed in the 1986 TSDR Survey.
USE: Explosives (dynamite is 75 percent nitroglycerin) and veterinary pharmaceuticals.

P087 - Osmium tetroxide: Three producers are listed in the SRI 1988 edition: one in EPA Region I, one in EPA Region II, and one in EPA Region III. Eight generators of P087 are listed in the 1986 TSDR Survey: two in Region II, one in Region IV, three in Region V, one in Region VI, and one in Region VIII.
USE: Oxidizing agent particularly for converting olefins to glycols. Catalyzes chlorate, peroxide, periodate, and other oxidations. As a fixing and staining agent for cell and tissue studies.

P096 - Phosphine: Eight producers are listed in the 1988 edition of SRI: one in Region I, one in Region II, one in Region IV, one in Region V, one in Region VI, and three in Region IX. Two facilities are listed as generators in the 1986 TSDR Survey: one in EPA Region V and one in EPA Region VI.
USE: Gaseous dopent for semiconductors.

P105 - Sodium azide: No producers are listed in the 1988 edition of SRI. Seventeen generators are listed in the 1986 TSDR Survey: one in EPA Region I, six in EPA Region II, three in EPA Region III, one in EPA Region IV, two in EPA Region V, three in EPA Region VI, and one in EPA Region X.
USE: In the preparation of hydrazoic acid, lead azide, pure sodium; as a propellant for inflating automotive safety bags; in weed and fruit rot control.

P112 - Tetranitromethane: One chemical producer in EPA Region II is listed in the SRI 1988 edition, and no generators of P112 are listed in the 1986 TSDR Survey.
USE: Oxidizer in rocket propellants. As explosive in admixture with toluene, to increase cetane number of diesel fuels. Reagent for detecting the presence of double bonds in organic compounds. Has been proposed as an irritant war gas.

P122 - Zinc phosphide: One chemical producer, located in EPA Region V, is listed in the SRI 1988 edition. One generator of P122 waste, located in EPA Region V, is listed in the 1986 TSDR Survey.
USE: In rat and field mouse poison preparations.

U023 - Benzotrichloride: In the 1988 edition of SRI, one company in Region II is listed as producing benzotrichloride, and the same company is listed as generating U023 in the 1986 TSDR Survey.
USE: Intermediate for pesticides.

U086 - 1,2-Diethylhydrazine: No producers are listed in the SRI 1988 edition. One generator of U086 in Region V is listed in the 1986 TSDR Survey.
USE: Polymer additives, fuels, photographic chemicals, and dyes.

U096 - a,a-Dimethylbenzylhydroperoxide: Four producers are listed in the SRI 1988 edition: two in Region II, one in Region III, and one in Region V. No generators are listed in the 1986 TSDR Survey.
USE: Intermediate in acetol/phenol production process.

U098 - 1,1-Dimethylhydrazine: One producer in Region VI is listed in the SRI 1988 edition. Three generators are listed in the 1986 TSDR Survey: one in Region II and two in Region V.
USE: Base for rocket fuel formulations.

U099 - 1,2-Dimethylhydrazine: No producers are listed in the SRI 1988 edition, and no generators are listed in the 1986 TSDR Survey.
USE: Base in rocket fuel formulations.

U103 - Dimethylsulfate: Two producers are listed in the SRI 1988 edition, and five generators are listed in the 1986 TSDR Survey. The two producers are located in EPA Regions II and III, and the five generators are located in Regions I, II, III, IV, and V.
USE: Methylating agent in the manufacture of many organic chemicals.

U109 - Diphenylhydrazine - No producers are listed in the SRI 1988 edition. Two generators are listed in the 1986 TSDR Survey, both located in EPA Region V.
USE: In the manufacture of hydrochloride, which is used as reagent for ababrnose and lactose.

U133 - Hydrazine - One producer, located in EPA Region V, is listed in the SRI 1988 edition, and 17 generators are listed in the 1986 TSDR Survey. Two of the generators are located in EPA Region I, one in Region II, one in Region III, three in Region IV, three in Region V, two in Region VI, two in Region VIII, one in Region IX, and two in Region X.
USE: Reducing agent; organic hydrazine derivative; rocket fuel.

U134 - Hydrogen fluoride: Four producers are listed in the SRI 1988 edition. According to the 1986 TSDR Survey, 16 facilities generate this waste: one in Region I, two in Region III, seven in

Region V, one in Region VI, one in Region VIII, three in Region IX, and one in Region X.
USE: Catalyst in petroleum industry; use in fluorination processes, especially in the aluminum industry; in the manufacture of fluorides; in making fluorine-containing plastics; and for separating uranium isotopes.

U135 - Hydrogen sulfide: Twelve facilities are listed in the SRI 1988 edition as producing hydrogen sulfide, and five facilities are listed in the 1986 TSDR Survey as generating U135 wastes. The facilities producing hydrogen sulfide are located as follows: one in EPA Region I, one in Region II, one in Region III, one in Region IV, two in Region V, three in Region VI, one in Region VIII, and two in Region IX. The facilities that generated hydrogen sulfide waste (U135) in 1986 are located as follows: one in Region I, one in Region III, one in Region IV, one in Region V, and one in Region IX.
USE: In the manufacture of chemicals; in metallurgy; as an analytical reagent.

U160 - Methyl ethyl ketone peroxide: No producers are listed in the SRI 1988 edition. Eight facilities are listed as generating U160 in the 1986 TSDR Survey: two in Region II, two in Region IV, one in Region V, one in Region VI, one in Region IX, and one in Region X.
USE: A widely used polymer-curing agent.

U189 - Phosphoric sulfide: Six facilities are listed as producers of phosphoric sulfide, and four facilities are listed as generators of U189 wastes. One facility producing phosphoric sulfide is located in EPA Region III, while three are in Region IV, one is in Region V, and one is in Region VII. The four facilities that generated U189 in 1986 are located in EPA Regions V, VI, VII, and X.
USE: In manufacture of lube oil additives and pesticides; manufacture of safety matches and ignition compounds; for introducing sulfur into organic compounds.

U249 - Zinc phosphide: One chemical producer, located in EPA Region V, is listed in the SRI 1988 edition. One generator of U249 waste, in EPA Region IX, is listed in the 1986 TSDR Survey.
USE: In rat and field mouse poison preparations.

5.3 Analytical Issues

For all but two P and U constituents (i.e., P015 - beryllium dust, and U109 - diphenylhydrazine), methods to analyze the listed constituents in treatment residues are not currently available. Although the Agency recognizes that these compounds exist, and that the manufacturers may have methods to verify their purity and determine their product specifications, there are no EPA-approved analytical procedures to ascertain trace quantities of these chemicals either in the raw sample or in the residues from treatment. In addition, EPA has not identified any constituents in these wastes that could be used as a surrogate or as an indicator compound. These wastes include the following:

P006 - Aluminum phosphide
P009 - Ammonium picrate
P056 - Fluorine
P068 - Methyl hydrazine
P073 - Nickel carbonyl
P081 - Nitroglycerine
P087 - Osmium tetroxide
P096 - Phosphine
P105 - Sodium azide
P112 - Tetranitromethane
P122 - Zinc phosphide (>10%)

U023 - Benzotrichloride
U086 - 1,2-Diethylhydrazine
U096 - a,a-Dimethylbenzylhydroperoxide
U098 - 1,1-Dimethylhydrazine
U099 - 1,2-Dimethylhydrazine
U103 - Dimethyl sulfate
U133 - Hydrazine
U134 - Hydrogen fluoride
U135 - Hydrogen sulfide
U160 - Methyl ethyl ketone peroxide
U189 - Phosphoric sulfide
U249 - Zinc phosphide (<10%)

In the future, methods may be developed and approved for use in analyzing some of the P and U reactive constituents. Table G-4 in Appendix G presents the analytical problems associated with some of the reactive listing constituents for the P and U waste codes.

5.4 Applicable/Demonstrated Technologies

This section identifies the applicable and demonstrated treatment technologies for the P and U wastes containing reactive listing constituents. To be applicable, a technology must theoretically be usable to treat the waste in question or a similar waste. To be demonstrated, the technology must be employed in full-scale operation for the treatment of the waste in question or of a similar waste.

Table K-4 Calculation of the Treatment Standard for Nickel-Treated Wastewater

Regulated constituent	Accuracy-corrected concentration	Mean	VF	Treatment standard total concentration (mg/l)
Nickel	0.355	0.369	1.20	0.44
	0.355			
	0.355			
	0.355			
	0.333			
	0.355			
	0.430			
	0.387			
	0.355			
	0.355			
	0.419			

Table K-3 Matrix Spike Recovery Data for Metals in Wastewater

Constituent	Original sample (µg/l)	Spike added (µg/l)	Sample		Duplicate	
			Spike result (µg/l)	Percent recovery[a]	Spike result (µg/l)	Percent recovery[a]
Antimony	<21	300	275	92	276	92
Arsenic	<10	50	70	140	66	132
Barium	1,420	5,000	5,980	91	5,940	90
Beryllium	1.4	25	25	94	24	90
Cadmium	4.2	25	26	87	27	91
Chromium	<4.0	50	35	70	34	68
Copper	<4.0	125	107	86	104	83
Lead	<5.0	25	22	88	19	76
Mercury	<0.2	1.0	0.9	90	1.1	110
Nickel	203	1,000	1,140	94	1,128	93
Selenium	<25	25	12	48	<25	NC
Silver	<4.0	50	42	84	38	76
Thallium	<10	50	51	102	48	96
Vanadium	<60	250	212	85	211	84
Zinc	2,640	10,000	12,600	100	12,400	98

NC = Not calculable.

[a] Percent recovery = [(spike result - original amount)/spike added] x 100.

Reference: USEPA 1988i.

Table K-2 Accuracy-Corrected Data for Treated Wastewater Residuals from Chemical Oxidation and Sludge Filtration

Constituent	Untreated concentration range[a] (mg/l)	Correction factor	Accuracy corrected concentration (mg/l) Sample Set # 1	2	3	4	5	6	7	8	9	10	11
Antimony	<10	1/0.92	(No substantial treatment)										
Arsenic	<1	1/1.00	(No substantial treatment)										
Barium	<10	1/0.90	<1.1	<1.1	<3.9	<11	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1
Beryllium	<2	1/0.90	(No substantial treatment)										
Cadmium	<5-13	1/0.87	<0.57	<0.57	<0.57	<5.7	<0.57	<0.57	<0.57	<0.57	<0.57	<0.57	<5.7
Hexavalent chromium[b]	0.08-893	1/1.06	0.010	0.179	-[c]	0.040	0.055	-[c]	0.114	<0.009	0.039	0.100	<0.009
Chromium	137-2581	1/0.68	0.176	0.176	0.294	0.147	0.162	0.147	0.176	0.221	0.147	0.176	0.265
Copper	72-225	1/0.83	0.253	0.181	0.253	0.084	0.169	0.145	0.193	0.193	0.096	0.169	0.289
Lead	<10-212	1/0.76	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Mercury	≤1	1/0.90	(No substantial treatment)										
Nickel	382-16330	1/0.93	0.355	0.355	0.355	0.355	0.333	0.355	0.430	0.387	0.355	0.355	0.419
Selenium	<10	1/0.48	(No substantial treatment)										
Silver	<2	1/0.76	(No substantial treatment)										
Thallium	<10	1/0.84	(No substantial treatment)										
Zinc	3.9-171	1/0.98	0.128	0.117	0.143	1.653	0.128	0.097	0.117	0.133	0.061	0.071	0.102

[a] Untreated concentrations are not adjusted for accuracy.

[b] Hexavalent chromium was actually treated by chromium reduction prior to chemical precipitation and sludge filtration.

[c] Concentration could not be measured because of analytical interference.

Table K-1 (continued)

Constituent/parameter	Concentration (ppm)					
	Sample Set #9		Sample Set #10		Sample Set #11	
	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate
BDAT Metals						
Antimony	<10	<1	<10	<1	<10	<1.00
Arsenic	<1	<0.1	<1	<0.1	<1	<0.10
Barium	<10	<1	<10	<1	<12	<1.00
Beryllium	<2	<0.2	<2	<0.2	<2	<0.20
Cadmium	<5	<0.5	<5	<0.5	23	<5
Chromium (hexavalent)	0.07	0.041	0.08	0.106	0.30	<0.01
Chromium (total)	939	0.10	395	0.12	617	0.18
Copper	225	0.08	191	0.14	137	0.24
Lead	<10	<0.01	<10	<0.01	136	<0.01
Mercury	<1	<0.1	<1	<0.1	<1	<0.10
Nickel	940	0.33	712	0.33	382	0.39
Selenium	<10	<1.0	<10	<1	<10	<1.00
Silver	<2	<0.2	<2	<0.2	<2	<0.2
Thallium	<10	<1.0	<10	<1	<10	<1.00
Zinc	5	0.06	5	0.070	135	0.100
Other Parameters						
Total organic carbon	2100		0		52	
Total solids	-		-		-	
Total chlorides	-		-		-	
Total organic halides	0		<300		300	

- = Not analyzed.

Note: Design and operating parameters are as follows:

pH during chromium reduction - 8.5 to 9.0.
Reducing agent - ferrous iron.
Ratio of reducing agent to hexavalent chromium - 3.2 to 10.
pH during chemical precipitation - 8 to 10.
Precipitation agent - lime.
Filter type - vacuum filter.

[a] Hexavalent chromium was actually treated by chromium reduction prior to chemical precipitation and sludge filtration.

Reference: USEPA 1986c.

Table K-1 (continued)

Constituent/parameter	Concentration (ppm)							
	Sample Set #5		Sample Set #6		Sample Set #7		Sample Set #8	
	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate
BDAT Metals								
Antimony	<10	<1	<10	<1	<10	<1	<10	<1
Arsenic	<1	<0.1	<1	<0.1	<1	<0.1	<1	<0.1
Barium	<10	<1	<10	<2	<10	<1	<10	<1
Beryllium	<2	<0.2	<2	<0.2	<2	<0.2	<2	<0.2
Cadmium	<5	<0.5	<5	<0.5	10	<0.5	<5	<0.5
Chromium (hexavalent)	917	0.058	734	-[a]	769	0.121	0.13	<0.01
Chromium (total)	2,236	0.11	2,548	0.10	2,314	0.12	831	0.15
Copper	91	0.14	149	0.12	72	0.16	217	0.16
Lead	18	<0.01	<10	<0.01	108	<0.01	212	<0.01
Mercury	1	<0.1	<1	<0.1	<1	<0.01	<1	<0.1
Nickel	1,414	0.310	588	0.33	476	0.40	669	0.36
Selenium	<10	<1	<10	<1	<10	<1	<10	<1
Silver	<2	<0.2	<2	<0.2	<2	<0.2	<2	<0.2
Thallium	<10	<1	<10	<1	<10	<1	<10	<1
Zinc	71	0.125	4	0.095	171	0.115	151	0.130
Other Parameters								
Total organic carbon	200		700		3400		5900	
Total solids	-		-		-		-	
Total chlorides	-		-		-		-	
Total organic halides	0		700		1900		800	

Table K-1 Performance Data for Chemical Oxidation and Sludge Filtration of a Metal-Bearing Wastewater Sampled by EPA

Constituent/parameter	Concentration (ppm)							
	Sample Set #1		Sample Set #2		Sample Set #3		Sample Set #4	
	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate	Treatment tank composite	Filtrate
BDAT Metals								
Antimony	<10	<1	<10	<1	<10	<1	<10	-
Arsenic	<1	<0.1	<1	<0.1	<1	<0.1	<1	<1
Barium	<10	<1	<10	<1	<10	3.5	<10	<10
Beryllium	<2	<0.2	<2	<0.2	<2	<0.2	<2	<2
Cadmium	13	<0.5	10	<0.5	<5	<0.5	<5	<5
Chromium (hexavalent)[a]	893	0.011	807	0.190	775	-[a]	0.6	0.042
Chromium (total)	2,581	0.12	2,279	0.12	1,990	0.20	556	0.10
Copper	138	0.21	133	0.15	133	0.21	88	0.07
Lead	64	<0.01	54	<0.01	<10	<0.01	<10	<0.01
Mercury	<1	<0.1	<1	<0.1	<1	<0.1	<1	<1
Nickel	471	0.33	470	0.33	16,330	0.33	6,610	0.33
Selenium	<10	<1	<10	<1	<10	<1	<10	<10
Silver	<2	<0.2	2	<0.2	<2	<0.3	<2	<2
Thallium	<10	<1	<10	<1	<10	<1	<10	<10
Zinc	116	0.125	4	0.115	3.9	0.140	84	1.62
Other Parameters								
Total organic carbon	2700		2800		500		2900	
Total solids	-		-		-		-	
Total chlorides	-		-		-		-	
Total organic halides	2500		3600		0		900	

APPENDIX K

PERFORMANCE DATA FOR CHEMICAL OXIDATION OF A METAL-BEARING WASTEWATER (USEPA 1988H)

Table J-4 Calculation of the Nonwastewater Treatment Standard for Nickel Treated by Stabilization

Constituent	Concentration (ppm) Sample Set #									Mean (mg/l)	Variability factor	Treatment standard (mg/l)
	1	2	3	4	5	6	7	8	9			
BDAT Metals												
Nickel												
Accuracy-corrected treated TCLP	0.05	0.03	0.27	0.02	0.04	0.06	0.11	0.04	0.02	0.072	4.47	0.32

Table J-3 Matrix Spike Recovery Data for the TCLP Extracts from Stabilization of F006 Waste

Constituent	Original amount found (ppm)	Duplicate (ppm)	% Error	Actual spike	% Recovery	Accuracy-correction factor
Arsenic	0.101[a]	0.01	0.0	0.086	94.5	1.06
	0.01[b]	0.01	0.0	0.068	104	0.96
Barium	0.3737[a]	0.3326	5.82	4.9474	91.9	1.09
	0.2765[b]	0.222	10.9	5.1462	97.9	1.02
Cadmium	0.0075[a]	0.0069	4.17	4.9010	97.9	1.02
	2.9034[b]	0.7555	58.7	6.5448	94.3	1.06
Chromium	0.3494[a]	0.4226	9.48	4.6780	85.8	1.17
	0.2213[b]	0.2653	9.0	4.5709	86.6	1.15
Copper	0.2247[a]	0.2211	0.81	4.8494	92.5	1.08
	0.1526[b]	0.1462	2.14	4.9981	97.0	1.03
Lead	0.3226[a]	0.3091	2.14	4.9619	92.9	1.08
	0.2142[b]	0.2287	3.27	4.6930	89.4	1.12
Mercury	0.001[a]	0.001	0.0	0.0034	92	1.09
	0.001[b]	0.001	0.0	0.0045	110	0.91
Nickel	0.028[a]	0.0264	6.87	4.5400	90.3	1.11
	0.4742[b]	0.0859	69.3	4.6093	86.6	1.15
Selenium[c]	0.101[a]	0.12	8.6	0.175	86	1.16
	0.043[b]	0.053	10.4	0.095	66[d]	0.96
Silver[c]	0.0437[a]	0.0399	4.55	4.2837	84.8	1.18
	0.0344[b]	0.0411	8.87	0.081	0.87[d]	114.9
Zinc	0.0133[a]	0.0238	28.3	5.0910	101.4	0.99
	27.202[b]	3.65	76.3	19.818	87.8	1.14

[a] At a mix ratio of 0.5.

[b] At a mix ratio of 0.2.

[c] For a mix ratio of 0.2, correction factors of 1.16 and 1.18 were used when correcting for selenium and silver concentrations, respectively.

[d] This value is not considered in the calculation for the accuracy-correction factor.

SOURCE: Memo to R. Turner, U.S. EPA/HWERL from Jesse R. Conner, Chemical Waste Management, dated January 20, 1988.

Table J-2 TCLP Performance Data for Stabilization of F006 Waste After Screening and Accuracy Correction of Treated Values

Constituent	Stream	Concentration (ppm) Sample Set # 1^a	2^b	3^a	4^b	5^b	6^b	7^b	8^b	9^b
Arsenic	Untreated TCLP	--	--	--	--	--	--	--	--	--
	Treated TCLP	--	--	--	--	--	--	--	--	--
Barium	Untreated TCLP	--	--	1.41	0.84	0.38	--	--	0.53	0.28
	Treated TCLP	--	--	0.34	0.25	0.21	--	--	0.29	0.09
Cadmium	Untreated TCLP	--	2.21	1.13	0.22	23.6	0.3	0.06	0.18	--
	Treated TCLP	--	0.01	0.06	0.01	0.01	0.01	0.01	0.01	--
Chromium	Untreated TCLP	--	0.76	0.43	--	25.3	38.7	360	--	--
	Treated TCLP	--	0.45	0.09	--	0.44	0.89	1.41	--	--
Copper	Untreated TCLP	--	368	--	4.6	1.14	31.7	8.69	483	16.9
	Treated TCLP	--	0.27	--	0.29	0.31	0.22	0.45	0.35	0.50
Lead	Untreated TCLP	--	10.7	--	--	--	3.37	1.0	4.22	50.2
	Treated TCLP	--	0.39	--	--	--	0.39	0.41	0.40	0.29
Mercury	Untreated TCLP	--	--	--	--	--	--	--	--	--
	Treated TCLP	--	--	--	--	--	--	--	--	--
Nickel	Untreated TCLP	0.71	22.7	1.1	0.52	9.78	730	152	644	16.1
	Treated TCLP	0.05	0.03	0.27	0.02	0.04	0.06	0.11	0.04	0.02
Selenium	Untreated TCLP	--	--	--	--	--	--	--	--	--
	Treated TCLP	--	--	--	--	--	--	--	--	--
Silver	Untreated TCLP	--	0.14	--	0.16	--	0.12	--	0.31	--
	Treated TCLP	--	0.06	--	0.05	--	0.06	--	0.06	--
Zinc	Untreated TCLP	0.16	219	5.41	2,030	867	1,700	0.62	650	1.29
	Treated TCLP	0.03	0.01	.03	0.04	0.03	0.04	0.02	0.02	0.01

Binding agent: cement kiln dust.

[a] Mix ratio is 0.2. The mix ratio is the ratio of the reagent weight to waste weight.

[b] Mix ratio is 0.5.

Reference: CWM Technical Note 87-117, Table 1 (CWM 1987).

Table J-1 (Continued)

Constituent	Stream	Concentration (ppm) Sample Set # 1	2	3	4	5	6	7	8	9
Mercury	Untreated total	-	-	-	-	-	-	-	-	-
	Untreated TCLP	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
	Treated TCLP[a]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Treated TCLP[b]	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel	Untreated total	435	989	259	37	701	19400	13000	23700	5730
	Untreated TCLP	0.71	22.7	1.1	0.52	9.78	730	152	644	16.1
	Treated TCLP[a]	0.04	1.5	0.23	0.10	0.53	16.5	0.40	15.7	1.09
	Treated TCLP[b]	-	0.03	0.15	0.02	0.04	0.05	0.10	0.04	0.02
Selenium	Untreated total	-	-	-	-	-	-	-	-	-
	Untreated TCLP	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.45
	Treated TCLP[a]	0.06	0.06	0.07	0.08	0.04	0.05	0.04	0.07	<0.01
	Treated TCLP[b]	-	0.11	0.11	0.14	0.09	0.11	0.07	0.07	<0.01
Silver	Untreated total	2.3	6.62	39	9.05	5.28	4.08	12.5	8.11	19.1
	Untreated TCLP	0.01	0.14	0.02	0.16	0.08	0.12	0.05	0.31	<0.01
	Treated TCLP[a]	0.03	0.03	0.20	0.03	0.04	0.03	0.03	0.03	<0.01
	Treated TCLP[b]	-	0.05	0.05	0.04	0.06	0.05	0.05	0.05	<0.01
Zinc	Untreated total	1560	4020	631	90200	35900	27800	120	15700	322
	Untreated TCLP	0.16	219	5.41	2030	867	1200	0.62	650	1.29
	Treated TCLP[a]	0.03	36.9	0.05	32	3.4	36.3	0.02	4.54	0.07
	Treated TCLP[b]	-	0.01	0.03	0.04	0.03	0.04	0.02	0.02	<0.01

Binding agent: cement kiln dust.

[a] Mix ratio is 0.2. The mix ratio is the ratio of the reagent weight to waste weight.

[b] Mix ratio is 0.5.

Note: Waste samples are from the following industries: set #1, unknown; set #2, auto part manufacturing; set #3, aircraft overhauling; set #4, zinc plating; set #5, unknown; set #6, small engine manufacturing; set #7, circuit board manufacturing; set #8, unknown; and set #9, unknown.

Reference: CWM Technical Note 87-117, Table 1 (CWM 1987).

Table J-1 Performance Data for Stabilization of F006 Waste

Constituent	Stream	Concentration (ppm) Sample Set # 1	2	3	4	5	6	7	8	9
Arsenic	Untreated total	-	-	-	-	-	-	-	-	-
	Untreated TCLP	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	0.88
	Treated TCLP[a]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
	Treated TCLP[b]	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
Barium	Untreated total	36.4	21.6	85.5	17.2	14.3	24.5	12.6	15.3	19.2
	Untreated TCLP	0.08	0.32	1.41	0.84	0.38	0.07	0.04	0.53	0.28
	Treated TCLP[a]	0.12	0.50	0.33	0.20	0.31	0.30	0.04	0.32	0.19
	Treated TCLP[b]	-	0.42	0.31	0.23	0.19	0.33	0.14	0.27	0.08
Cadmium	Untreated total	1.3	31.3	67.3	1.30	720	7.28	5.39	5.81	5.04
	Untreated TCLP	0.01	2.21	1.13	0.22	23.6	0.3	0.06	0.18	0.01
	Treated TCLP[a]	0.01	0.50	0.06	0.01	3.23	0.02	0.01	0.01	<0.01
	Treated TCLP[b]	-	0.01	0.02	0.01	0.01	0.01	0.01	0.01	<0.01
Chromium	Untreated total	1270	755	716	110	12200	3100	42900	47.9	644
	Untreated TCLP	0.34	0.76	0.43	0.18	25.3	38.7	360	0.04	0.01
	Treated TCLP[a]	0.51	0.40	0.08	0.23	0.25	0.21	3.0	0.10	0.03
	Treated TCLP[b]	-	0.39	0.20	0.30	0.38	0.76	1.21	0.2	0.21
Copper	Untreated total	40.2	7030	693	1510	160	1220	10600	17600	27400
	Untreated TCLP	0.15	368	1.33	4.6	1.14	31.7	8.69	483	16.9
	Treated TCLP[a]	0.20	5.4	1.64	0.30	0.20	0.21	0.40	0.50	3.18
	Treated TCLP[b]	-	0.25	1.84	0.27	0.29	0.20	0.42	0.32	0.46
Lead	Untreated total	35.5	409	25.7	88.5	52	113	156	169	24500
	Untreated TCLP	0.26	10.7	0.26	0.45	0.45	3.37	1.0	4.22	50.2
	Treated TCLP[a]	0.30	0.40	0.30	0.30	0.24	0.30	0.30	0.31	2.39
	Treated TCLP[b]	-	0.36	0.41	0.34	0.36	0.36	0.38	0.37	0.27

APPENDIX J

PERFORMANCE DATA FOR STABILIZATION OF F006 WASTE (USEPA 1988g)

TABLE 4-173
BDAT TREATMENT STANDARDS FOR WASTEWATERS

CONSTITUENTS	LONG TERM AVG. (PPB)	ACF	VF	BDAT TRT. STANDARD (PPB)
N-Nitrosomorpholine	73	1.42	2.8	290
N-Nitrosopiperidine	2.4	1.42	2.8	10
n-Nitrosopyrrolidine	2.4	1.42	2.8	10
5-Nitro-o-toluidine	58	1.42	2.8	230
Pentachlorobenzene	10	1.42	2.8	40
Pentachloroethane	10	1.42	2.8	40
Pentachloronitrobenzene	10	1.42	2.8	40
Pentachlorophenol	20	1.47	2.8	82
Phenacetin	2400	1.42	2.8	9542
Phenanthrene	10	NA	5.89125	59
Phenol	10.383	NA	2.49705	26
Phthalic anhydride	5	1.42	2.8	20
Pronamide	21	1.42	2.8	83
Pyrene	11.333	NA	5.89125	67
Resorcinol	5.5	2.7	2.8	42
Safrole	2400	1.42	2.8	9542
1,2,4,5-Tetrachlorobenzene	10	1.42	2.8	40
2,3,4,6-Tetrachlorophenol	6.8	2.7	2.8	51
1,2,4-Trichlorobenzene	10	1.64	2.8	46
2,4,5-Trichlorophenol	1	2.7	2.8	8
2,4,6-Trichlorophenol	1	2.7	2.8	8
Tris(2,3-dibromopropyl) phosphate	20	1.42	2.8	80
Acrylamide	262	1.42	2.8	1042
Antimony	470	NA	4.1	1930
Arsenic	340	NA	4.1	1390
Barium	280	NA	4.1	1150
Beryllium	200	NA	4.1	820
Cadmium	49	NA	4.1	200
Chromium(total)	70	NA	5.28	370
Copper	390	NA	3.28	1280
Lead	80	NA	3.5	280
Mercury	36	NA	4.1	150
Nickel	220	NA	2.5	550
Selenium	200	NA	4.1	820
Silver	70	NA	4.1	290
Thallium	340	NA	4.1	1400
Vanadium	3	5	2.8	42
Zinc	230	NA	4.43	1020
Cyanide	180	NA	6.68	1200
Fluoride	14500	NA	2.41	35000
Sulfide	1000	5	2.8	14000
Aldrin	1.49	5	2.8	21
alpha-BHC	0.01	5	2.8	0.14
beta-BHC	0.01	5	2.8	0.14
delta-BHC	1.632	5	2.8	23
gamma-BHC	0.12	5	2.8	1.68
Chlordane	0.2336	5	2.8	3.27

Fluoride. The data available for fluoride were compiled from the BDAT, WERL, and ITD databases. Demonstrated treatment technologies included AAS, ChPt, RO, L+Sed, and L+Sed+Fil. The technology size included bench, pilot, and full-scale data. The resulting effluent concentrations ranged from 200 ppb to 14,500 ppb.

The BDAT standard was set using L+Sed technology and an achievable effluent of 14,500 ppb. L+Sed was selected as BDAT since these data represent ITD full scale treatment performance data from the CMDB. L+Sed shows equivalent substantial treatment to L+Sed+Fil.

The resulting BDAT treatment standard for fluoride is 35,000 ppb as shown in Table 4-173.

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TABLE
WASTEWATER TREATMENT PERFORMANCE DATA
FOR FLUORIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AAS	Full	12648		10000-100000		200.000		98.8	WERL
AAS	Full	12648		1000-10000		200.000		95.2	WERL
ChPt (B)	Bench	1313E		1000-10000		300.000		92.5	WERL
L+Sed	Full					14500.000			ITD-CMDB
L+Sed+Fil	Full					14500.000			ITD-CMDB
LL+SS+AC	Full	K103/K104		200	4	482.000			BDAT
RO	Pilot	180A		100-1000	18	210.000		74	WERL
RO	Full	12648		1000-10000		600.000		88	WERL
RO	Full	12648		1000-10000		800.000		88	WERL

KEY TO TREATMENT TECHNOLOGIES

AAS — Activated Alumina Sorption
AC — Activated Carbon
AFF — Aerobic Fixed Film
AL — Aerobic Lagoons
API — API Oil/Water Separator
AS — Activated Sludge
AirS — Air Stripping
AnFF — Anaerobic Fixed Film
AnL — Anaerobic Lagoons
BGAC — Biological Granular Activated Carbon
CAC — Chemically Assisted Clarification
Chem/Cond — Chemical Conditioning
ChOx — Chemical Oxidation (Parentheses shows oxidation chemical ie. ChOx (Oz) - is ozone)
ChOx/Pt — Chemical Oxidation/Precipitation
ChPt — Chemical Precipitation
Chred — Chemical Reduction
Chred/Pt — Chemical Reduction/Precipitation
CN/Ox — Cyanide Oxidation
COAG — Coagulation
DAF — Dissolved Air Flotation
Fil — Filtration
FLOAT — Floatation
GAC — Activated Carbon (Granular)
Gr/Rem — Grease/Oil Removal
KPEG — Dechlorination of Toxics using an Alkoxide (Formed by the reaction of potassium hydroxide with polyethylene glycol (PEG400))
IE — Ion Exchange
In-PB — In-Plant Biological Treatment
L — Lime
LL — Liquid, Liquid Extraction
Neut — Neutralization
PACT — Powdered Activated Carbon Addition to Activated Sludge
RBC — Rotating Biological Contactor
RO — Reverse Osmosis
SBR — Sequential Batch Reactor
SCOx — Super Critical Oxidation
SExt — Solvent Extraction
SS — Steam Stripping
Sed — Sedimentation
TF — Trickling Filter
UF — Ultrafiltration
UV — Ultraviolet Radiation
WOx — Wet Air Oxidation

NOTES:

____ + ____ is the first process unit followed in process train by the second ie. AS + Fil - Activated Sludge followed by Filtration.

____ w ____ is the two units together ie. UFwPAC - Ultrafiltration using Powdered Activated Carbon.

____ (B) is batch instead of continuous flow.

DATABASE KEY

BDAT	Best Demonstrated Available Technology
ITD	Industrial Technology Division
NPDES	National Pollutant Discharge Elimination System
WAO	Wet Air Oxidation
WERL	Water Engineering Research Laboratory
OCPSF	Organic Chemicals, Plastics, and Synthetic Fibers
CMDB	Combined Metals Database

APPENDIX I

WASTEWATER TREATMENT PERFORMANCE DATA FOR FLUORIDE (USEPA 1989E)

Table H-1 (continued)

Compound	Molecular weight	Aqueous Solubility	Concentration		Adsorbability	
			Initial (C_o)	Final (C_s)	g Compound/ g Carbon	Percent reduction
Esters						
Methyl acetate	74.1	31.9	1,030	760	0.054	26.2
Ethyl acetate	88.1	8.7	1,000	495	0.100	50.5
Propyl acetate	102.1	2	1,000	248	0.149	75.2
Butyl acetate	116.2	0.68	1,000	154	0.169	84.6
Primary amyl acetate	130.2	0.2	985	119	0.175	88.0
Isopropyl acetate	102.1	2.9	1,000	319	0.137	68.1
Isobutyl acetate	116.2	0.63	1,000	180	0.164	82.0
Vinyl acetate						
Ethylene glycol mono-ehtyl ether acetate	132.2	22.9	1,000	342	0.132	65.8
Ethyl acrylate	100.1	2.0	1,015	226	0.157	77.7
Butyl acrylate	128.2	0.2	1,000	43	0.193	95.9
Ketones						
Acetone	58.1	--	1,000	782	0.043	21.8
Methyl ethyl ketone	72.1	26.8	1,000	532	0.094	46.8
Methyl propyl ketone	86.1	4.3	1,000	305	0.139	69.5
Methyl butyl ketone	100.2	v.sl.sol.	988	191	0.159	80.7
Methyl isobutyl ketone	100.2	1.9	1,000	152	0.169	84.8
Methyl isoamyl ketone	114.2	0.54	986	146	0.169	85.2
Diisobutyl ketone	142.2	0.05	300	nil	0.060	100.0
Cyclohexanone	98.2	2.5	1,000	332	0.134	66.8
Acetophenone	120.1	0.55	1,000	28	0.194	97.2
Isophorone	138.2	1.2	1,000	34	0.193	96.6
Organic Acids						
Formic acid	46.0	--	1,000	765	0.047	23.5
Acetic acid	60.1	--	1,000	760	0.048	24.0
Propionic acid	74.1	--	1,000	674	0.065	32.6
Butyric acid	88.1	--	1,000	405	0.119	59.5
Valeric acid	102.1	2.4	1,000	203	0.159	79.7
Caproic acid	116.2	1.1	1,000	30	0.194	97.0
Acrylic acid	72.1	--	1,000	355	0.129	64.5
Benzoic acid	122.1	0.29	1,000	89	0.183	91.1

Reference: Giusti, Conway, and Lawson 1974.

Table H-1 Amenability of Typical Organic Compounds to Activated Carbon Adsorption

			Concentration		Adsorbability	
Compound	Molecular weight	Aqueous solubility	Initial (C_o)	Final (C_s)	g Compound/ g Carbon	Percent reduction
Alcohols						
Methanol	32.0	--	1,000	964	0.007	3.6
Ethanol	46.1	--	1,000	901	0.020	10.0
Propanol	60.1	--	1,000	811	0.038	18.9
Butanol	74.1	7.7	1,000	466	0.107	53.4
n-Amyl alcohol	88.2	1.7	1,000	282	0.155	71.8
n-Hexanol	102.2	0.58	1,000	45	0.191	95.5
Isopropanol	60.1	--	1,000	874	0.025	12.6
Allyl alcohol	58.1	--	1,010	789	0.024	21.9
Isobutanol	74.1	8.5	1,000	581	0.084	41.9
t-Butanol	74.1	--	1,000	705	0.059	29.5
2-Ethyl butanol	102.2	0.43	1,000	145	0.170	85.5
2-Ethyl hexanol	130.2	0.07	700	10	0.138	98.5
Amines						
Di-N-Propylamine	101.2	--	1,000	198	0.174	80.2
Butylamine	73.1	--	1,000	480	0.103	52.0
Di-N-Butylamine	129.3	--	1,000	130	0.174	87.0
Allylamine	57.1	--	1,000	686	0.063	31.4
Ethylenediamine	60.1	--	1,000	893	0.021	10.7
Diethylenetriamine	103.2	--	1,000	706	0.062	29.4
Diethanolamine	105.3	95.4	996	722	0.057	27.5
Triethanolamine	149.1	--	1,000	670	0.067	33.0
Monoisopropanolamine	75.1	--	1,000	800	0.040	20.0
Diisopropanolamine	133.2	87	1,000	543	0.091	45.7
Aromatics						
Benzene	78.1	0.07	416	21	0.080	95.0
Toluene	92.1	0.047	317	66	0.050	79.2
Ethyl benzene	106.2	0.02	115	18	0.019	84.3
Phenol	94	6.7	1,000	194	0.161	80.6
Hydroquinone	110.1	6.0	1,000	167	0.167	83.3
Aniline	93.1	3.4	1,000	251	0.150	74.9
Styrene	104.2	0.03	180	18	0.028	-88.8
Nitrobenzene	123.1	0.19	1,023	44	0.196	95.6

carbon. Compounds containing nitro groups, which are reactive waste constituents, are as follows:

- Ammonium picrate (P009), which is ammonium salt or trinitrophenol (the dinitrophenols have been extensively studied)
- Tetranitromethane (P112)

Nitrate esters (i.e., nitroglycerin (P081)) are known to be treatable by carbon adsorption. The listed waste, K045, is spent carbon for treatment of wastewaters from production of nitrate ester and other nitrated explosives.

3. Other Polar Compounds

Acid, ester, ketone, and alcohol compounds removed from wastewater using activated carbon have been studied extensively (Belfort 1981). The following reactive wastes fit into one or more of these compound classes:

- Dimethyl sulfate (U103) is an ester.
- Dimethyl benzyl hydroperoxide (U096) and methyl ethyl ketone peroxide (U160) are both organo peroxides, which are structurally similar to alcohols.

The purpose of this appendix is to discuss the applicability of carbon adsorption to wastewaters containing reactive listing constituents. The discussion is subdivided by waste type so that the reader can readily understand the types of reactive wastes to which this technology is applicable.

Carbon adsorption is generally applicable to organic compounds containing one or more polar groups. The following are the major classes of compounds for which applicability can be readily established (Hutton 1981). Table F-1 shows the amenability of typical organic compounds to activated carbon adsorption.

1. Amines and Aminic-Like Compounds

A considerable volume of information exists on the removal of ammonia and amines from wastewaters. Reactive constituents containing amino (NH_2, NH or N) groups should behave similarly to the amines already studied, such as dipropylamine and aniline. Compounds containing NH_2, NH, or N groups among the reactive wastes are as follows:

- Methyl hydrazine (P068)
- N N diethyl hydrazine (U086)
- 1,1 diethyl hydrazine (U098)
- 1,2 diethyl hydrazine (U099)
- 1,2 diphenyl hydrazine (U109)
- Hydrazine (U133)

For aromatic hydrazines, comparisons should be made with aniline. Di-n-propylamine should be used as a surrogate or the alkylamines and ammonia should be used as a surrogate for free hydrazine.

2. Nitrated Compounds

A very large volume of information exists on the removal of nitrated phenols, aromatics, and aliphates from wastewater using activated

APPENDIX H

CARBON ADSORPTION PERFORMANCE DATA

Table G-4 **Analytical Problems Associated with the Listing Constituents for Reactive P and U Waste Codes**

Chemical	CAS no.	Reasons for analytical problems
P006 - Aluminum phosphide	20859738	5
P009 - Ammonium picrate	131748	3
P056 - Fluorine	7782414	5
P068 - Methyl hydrazine	60344	5
P073 - Nickel carbonyl	13463393	5
P081 - Nitroglycerine	55630	2
P087 - Osmium tetroxide	20816120	1
P096 - Phosphine	7803512	3
P105 - Sodium azide	26628228	3
P107 - Strontium sulfide	1314961	1
P112 - Tetranitromethane	509148	5
P122 - Zinc phosphide (>10%)	1314847	5
U023 - Benzotrichloride	98077	5
U086 - 1,2-Diethylhydrazine	1615801	4
U096 - a,a-Dimethylbenzyhydroperoxide	80159	3
U098 - 1,1-Dimethylhydrazine	57147	5
U099 - 1,2-Dimethylhydrazine	540738	5
U103 - Dimethyl sulfate	77781	5
U133 - Hydrazine	302012	3
U134 - Hydrogen fluoride	7664393	5
U135 - Hydrogen sulfide	7783064	5
U160 - Methyl ethyl ketone peroxide	1338234	5
U186 - 1,3-pentadiene	504609	3
U189 - Phosphoric sulfide	1314803	2
U249 - Zinc phosphide (<10%)	1314847	5

1. This constituent can be analyzed for the metal but not the inorganic compounds. It is the compound that gives the waste its reactive characteristic; therefore, EPA believes that a numerical standard based on metal content of the residuals may not control the reactive characteristic of the waste.

2. Only high performance liquid chromatography (HPLC) techniques have been identified for analysis of this constituent. This method, SW-864 Method 8310, is used to determine the concentration of certain polynuclear aromatic hydrocarbons (PAHs) in ground water and wastes. Use of this method presupposes a high expectation of finding the specific compounds of interest; if this method is used to screen samples for any or all of the applicable PAHs listed under the method, the analyst must develop protocols to verify the identity of those constituents. This inability to positively identify chemicals in a complex matrix is typical of methods that employ HPLC and limits the usefulness of such methods when analyzing complex samples containing unknown constituents.

3. The Agency knows of no methods that are available for analysis of this constituent.

4. Standards are not readily available for this constituent. Analytical standards are chemical compounds of guaranteed purity that can be used for calibrating instruments and checking the accuracy of the data. The Agency considers analytical standards for a constituent to be commercially unavailable if no chemical manufacturer or other supply sources will sell reasonably pure samples of that constituent to analytical laboratories. Without using a standard for a particular constituent, the analyst cannot ascertain that the analytical results for that constituent are reproducible. If the results are not reliable and reproducible, the ensuing numerical treatment standards are fallible and unenforceable.

5. This constituent decomposes in or reacts with water. When placed in water, some constituents separate into ions, while others decompose or react with the water. Such constituents are considered unstable in water. This instability inhibits or even prevents the direct measure of a constituent's concentration in aqueous wastes, treatment residues, and leaching solutions from such wastes.

Reference: Alchowiak 1989.

Table G-3 **(Continued)**

Waste code	**EPA Region**	**State**	**SIC codes**	**Industry**	**Volume**
U135-Hydrogen sulfide	**I**	**MA**	**3861**	**Photographic equipment and supplies**	**1500.0G**
	III	**DE**	**2800**	**General chemical manufacturing**	
	IV	**SC**	**3751/9711**	**Motorcycles, bicycles, and parts/ national security**	**2.0T**
	V	**WI**	**2800/2869**	**General chemical manufacturing/ industrial organic chemicals**	**1.0G**
	IX	**CA**	**2911**	**Petroleum refining**	**1.0T**
U160-Methyl Ethyl ketone peroxide	**II**	**NJ**	**2834**	**Pharmaceutical preparations**	**1320.0G**
		NY	**2869**	**Industrial organic chemicals**	**17.0T**
	IV	**FL**	**9661**	**Space research and technology**	**1.0T**
		SC	**3731/9711**	**Ship building and repairing/ national security**	**1.0T**
	V	**WI**	**2800/2869**	**General chemical manufacturing/ industrial organic chemicals**	**1.0G**
	VI	**LA**	**3764/3471/ 3499/3479**	**Space propulsion units and parts/ plating and polishing/fabricated metal products/metal coating and allied services**	**1.0T**
	IX	**CA**	**2869**	**Industrial organic chemicals**	**1.5T**
	X	**WA**	**9711/3731**	**National security/ship building and repairing**	**4.0G**
U186-1,3-Pentadiene					
U189-Phosphorus sulfide	**V**	**IL**	**2869/2818/ 2819**	**Industrial organic chemicals/ organic pesticide products/ industrial inorganic chemicals**	**90.0T**
	VI	**TX**	**2869/2821/ 2899**	**Industrial organic chemicals/ plastics, materials, and resins/ chemical preparations**	**1.0G**
	VII	**MO**	**2879/2818**	**Agricultural chemicals/organic pesticides products**	**3.0T**
	X	**WA**	**3721**	**Aircraft**	**1.0T**
U249-Zinc phosphide (<10%)	**IX**	**CA**	**9199/2899**	**General government/chemical preparations**	**1.0T**

G = gallons
P = pounds
T = tons

Note: The default unit for the survey is tons.

Reference: USEPA 1986a.

Table G-3 (Continued)

Waste code	EPA Region	State	SIC codes	Industry	Volume
U134-hydrogen fluoride	IX	CA	3629/3832 3671/3693	Electrical industrial apparatus/ Optical instruments and lenses/ electron tubes, receiving type X-ray apparatus and tubes	4100G
			3999	Manufacturing industries	57T/3500G
			3674	Semiconductors and related devices	527T
	III	DE	2800	General chemical manufacturing	8.0P
	V	IN	3674/3651/3471/3469	Semiconductors and related devices/radio and TV receiving sets/electron tubes, receiving type/metal stampings	44670T
	I	MA	4226/4959 2899	Special warehousing and storage/ Sanitary services/chemical preparations	55G
	V	MN	2821/2641/3861/2851	Plastics, materials and resins/ paper coating and glazing/ photographic equipment and Supplies/paints and allied products	1265G
	VIII	MT	2911	Petroleum refining	3.0T
	V	OH	9711/3721	National security/aircraft	1.0T
			7391	research and development laboratories	1.0G
			3229/3471	Pressed and blown glass/ Plating and polishing	4,800,00G
			3641	Electric lamps	1.0P
	III	PA	2819/2873 2869	Adhesives and sealants/ Nitrogenous fertilizers Industrial organic chemicals	55.0G
U134-hydrogen fluoride	VI	TX	2869/2821 2899	Industrial organic chemicals/ plastics, materials and resins/ Chemical preparations	15.0G
	X	WA	9711/8922 4911/1541	National security/noncommercial research organizations/electric services/industrial buildings and warehouses	67.0P
	V	WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G

Table G-3 (Continued)

Waste code	EPA Region	State	SIC codes	Industry	Volume
U109-1,2-Diphenylhydrazine	V	MI	2869/2879	Industrial organic chemicals/ agricultural chemicals	5.0T
		WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G
U133-hydrazine	I	CT	2834	Pharmaceutical preparations	2.0T
		MA	4226/4959/ 2899	Special warehousing and storage/ sanitary services/chemical preparations	55.0G
	II	NJ	7391	Research and development laboratories	1.0G
	III	DE	2800	General chemical manufacturing	17.0P
	IV	FL	9661	Space research and technology	18.5T
		NC	9199	General government	1.0G
		SC	3731	Ship building and repairing	2.0T
	V	OH	7391	Research and development laboratories	5.0G
		WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	110.0G
			2869/2843/ 2899/2841	Industrial organic chemicals/ surface active agents/chemical preparations/soap and other detergents	26.0G
	VI	LA	2869/2819	Industrial organic chemicals/ industrial inorganic chemicals	4.0T
		TX	8062/8071	General medical and surgical hospitals/medical laboratories	28.0P
	VIII	CO	9711/3499	National security/fabricated metal products	1.0G
		CO	3761/3764/ 7391/3769	Guided missiles and space vehicles/ space propulsion units and parts/ research and development laboratories/space vehicle equipment	22.0T
	IX	CA	3679/9661/ 2999	Electronic components/space research and technology/ petroleum and coal products	1.0T
	X	WA	9711/3731	National security/ship building	1.0T
			9711/8922/ 4911/1541	National security/noncommercial research organizations/electric services/industrial buildings and warehouses	446.0P

Table G-3 (Continued)

Waste code	EPA Region	State	SIC codes	Industry	Volume
P105-(continued)				architectural services/radio and TV communication equipment	
	VI	MO	8221/8062	Colleges and universities/ general medical and surgical hospitals	1.0T
		TX	8062/8071	General medical and surgical hospitals/medical laboratories	77.0P
	X	WA	9711/8922/ 4911/1541	National security/noncommercial research organizations/electric services/industrial buildings and warehouses	5.0P
P112-Tetranitromethane					
P122-Zinc phosphide (>10%)	V	OH	3641	Electric lamps	1.0P
U023-Benzotrichloride	II	NY	2800/2812 2819/2869	General chemical manufacturing/ alkalies and chlorine/industrial inorganic chemicals/industrial organic chemicals	626.0T
U086-N,N-Diethylhydrazine	V	WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G
U096-a,a-Dimethyl(benzyl hydroperoxide)					
U098-1,1-Dimethylhydrazine	II	NJ	2899/2819/ 2869	Chemical preparations/industrial inorganic chemicals/industrial organic chemicals	1.0T
	V	OH	7391	Research and development laboratories	1.0G
		WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G
U099-1,2-Dimethylhydrazine					
U103-Dimethyl sulfate	I	MA	4226/4959/ 2899	Special warehousing and storage/ sanitary services/chemical preparation	12.0G
	II	NY	7301		2.0G
	III	DE	2800	General chemical manufacturing	1.0P
	IV	NC	9199	General government	1.0G
	V	WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G

Table G-3 (Continued)

Waste code	EPA Region	State	SIC codes	Industry	Volume
P087-Osmium tetroxide	III	DE	2800	General chemical manufacturing	1.5P
		PA	2647/2611	Sanitary paper products/pulp mills	1.0P
	IV	NC	9199	General government	1.0T
	V	IL	8221/2800/ 8071/2833	Colleges and universities/ general chemical manufacturing/ medical laboratories/medicinals and botanicals	161.0G
		OH	7391	Research and development	1.0G
		WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G
	VI	TX	8062/8071	General medical and surgical hospitals/medical laboratories	64.0P
	VIII	MO	8221/8062	Colleges and universities/general medical and surgical hospitals	1.0T
P096-Phosphine	V	NM	8922/9199	Noncommercial research organizations/general government	1.0G
	VI	WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G
P105-Sodium azide	I	CT	2834		
	II	NJ	2869/2819	Industrial organic chemicals/ industrial organic chemicals	1.0T
			2800/2821/ 2869/2899	General chemical manufacturing/ plastic materials and resins/ industrial organic chemicals/ chemical preparations	1.0T
			2834	Pharmaceutical preparations	1.0T
			2899/2819/ 2869	Chemical preparations/industrial inorganic chemicals/industrial organic chemicals/chemical preparations	1.0T
			2834/2831	Pharmaceutical preparations/ biological products	1.0T
		NY	2800	General chemical manufacturing	1.0T
	III	DE	2899	Chemical preparations	1.0T
			2800	General chemical manufacturing	61.0T
		PA	2833/2379	Medicinals and botanicals/ agricultural chemicals	2.0G
	IV	NC	9199	General government	1.0T
	V	OH	2879/2869/ 2816/2819	Agricultural chemicals/ industrial organic chemicals/ inorganic pigments/industrial inorganic chemicals	10.0P
		WI	2800/2869	General chemical manufacturing/ industrial organic chemicals	1.0G
	VI	MO	2869/2892/ 8911/3662	Industrial organic chemicals/ explosives/engineering and	1.0T

Table G-3 **Generation Information for Reactive U and P Wastes According to the 1986 TSDR Survey**

Waste code	**EPA Region**	**State**	**SIC codes**	**Industry**	**Volume**
P006-Aluminum phosphide	IV	SC	3731/9711	Ship building and repairing/National security	0.5T
P009-Ammonium picrate					
P015-Beryllium dust	II	NY	7301		3.0G
	III	MD	3764	Space propulsion units and parts	24.0G
		VA	9711	National security	1.0T
	IV	FL	9199/9711/3471/3721	General government/national Security/plating and polishing/Aircraft	1.0T
		SC	3731/9711	Ship building and repairing/national security	3.0T
	V	OH	3641	Electric lamps	1.0P
	VI	TX	3483/2892	Ammunition, except for small arms/explosives	8.0T
	VIII	CO	3761/3764/7391/3769	Guided missiles and space vehicles/space propulsion units and parts research and development laboratories/space vehicle equipment	660.0G, 18.0T
	IX	CA	3679/9661/2999	Electronic components/space research and technology/petroleum and coal products	1.0T
			3629/3832/3671/3693	Electrical industrial apparatus/optical instruments and lenses/electron tubes, receiving type/x-ray apparatus and tubes	27.0T
			3761	Guided missiles and space vehicles	1.0G
			3699	Electrical equipment and supplies	1608.0G
	X	WA	9711/8922/4911/1541	National security/noncommercial research organizations/electric services/industrial buildings and warehouses	1.0T
P056-Fluorine	II	NJ	2869/2833	Industrial organic chemicals/medicinals and botanicals	1.0T
P068-Methyl hydrazine	III	DE	2800	General chemical manufacturing	831.0P
	V	WI	2800/2869	General chemical manufacturing/industrial organic chemicals	1.0G
	VI	NM	9661	Space research and technology	30,000G
P073-Nickel carbonyl	III	DE	2800	General chemical manufacturing	1.0P
P081-Nitroglycerin					

Table G-2 (continued)

WASTE CODE	WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	QUANTITY	PERCENT SOLIDS	PERCENT WATER	CONSTITUENTS PRESENT IN PERCENTAGE LEVELS
U133	Nonhalogenated solvent	Laboratory wastes/ discarding of out-of-date chemicals	1 G	0	0	Hydrazine(>90%)
U133	Concentrated off-spec or discarded product	Laboratory wastes/ discarding of out-of-date chemicals	1 T	DK	DK	Hydrazine(>90%)
U133(MIXED)	Other aqueous waste with low dissolved solids	Discarding of out-of-date products or chemicals	1 T	0	80	Hydrazine(10-25%)
U133(MIXED)	Nonhalogenated solvent	Reaction/synthesis media processing	91 T	DK	DK	N
U133(MIXED)	Other organic liquid	Clean out of process equipment	0	DK	DK	N
U133(MIXED)	Empty or crushed metal drums or containers	Other waste production process	0	99	1	N
U133(MIXED)	Other inorganic liquid/aqueous waste with low	Accidental spills or discharges	ND	0	0	Hydrazine(>90%)
U133 (MIXED)	Wastewater or aqueous mixture	Clean out of process equipment/cleanup of spills	821448 T	1	99	Methanol(500ppm-0.1%),
U133(MIXED)	Soil contaminated with organics only/inorganic gases	Cleanup of spill residues	1 T	100	0	N
U133(MIXED)	Acidic aqueous waste	Discarding of off-spec materials/cleanup of spills	595 G	0	95	Hydrazine(25-50%)
U133(MIXED)	Aqueous waste w/other reactives(explosives)	Accidental spills or discharges	2 G	0	95	Hydrazine(25-50%)
U133(MIXED)	Other reactive salts/chemicals	Other waste production process/lab wastes	82 G	99	0	Hydrazine(0.1-1%)
U133(MIXED)	Other organic liquid	Discarding of out-of-date products or chemicals	0	NA	18	Hydrazine(75-90%)
U133 (MIXED)	Other inorganic solids	Filtration/centrifuging	3 T	100	NA	N
U133(MIXED)	Empty or crushed metal drums or containers	Other remedial action/cleanup	0	99	DK	N
U134	Other untreated waste	Laboratory wastes	100 G	0	10	Hydrogen fluoride(25-50%)
U134	Other inorganic liquid	Discarding of off-spec material	4 T	NA	NA	N
U134	Other treatment residue	Other pollution control or waste treatment process	40500 G	NA	80	N
U134	Acidic aqueous waste	Other process	880 T	0	97	N
U134	Acidic aqueous waste	Other process	132 G	DK	DK	N
U134	Still btms of halogenated solvents or other organic liquids	Other process	1285 G	DK	DK	DK
U134 (MIXED)	Spent acid without metals	Distillation and fractionation/heavy ends or still bottoms	28710 G	P	P	N
U134 (MIXED)	Other I or k waste, as described	None	300 G	DK	DK	N
U134 (MIXED)	Spent acid without metals	None	550 G	DK	DK	Hydrogen fluoride(25-50%)
U134 (MIXED)	spent acid without metals	Other waste production process	3400 G	P	P	N
U134 (MIXED)	Acidic aqueous waste	Other waste production process	26815 G	0	99	Hydrogen fluoride(1-10%)
U134 (MIXED)	Mixed lab packs	Discarding of out-of-date products or chemicals	1980 G	P	P	N
U134 (MIXED)	Empty fiber or plastic containers	Other one-time process	18 G	99	1	Hydrogen fluoride(500ppm-0.1%)
U134 (MIXED)	Wastewater or aqueous mixture	Other cleaning or degreasing process/stripping	19300 G	0	99	N
U134 (MIXED)	Other waste inorganic chemicals	Cleanup of spill residues	1595 G	P	P	Hydrogen fluoride(1-10%)
U134 (MIXED)	Spent acid without metals	Stripping/clean out of process equipment	180 G	8	62	Hydrogen fluoride(>90%)
U134 (MIXED)	Spent acid without metals	Other process	23000 G	0	74	N
U134 (MIXED)	Other aqueous waste with low dissolved solids	Wastewater treatment	997000 G	1	99	N
U134 (MIXED)	Other organic liquid	Laboratory wastes	3 T	NA	NA	Hydrogen fluoride(1-10%),Chlorinated fluorocarbons,NOS(500ppm-0.1%)
U134 (MIXED)	Spent acid without metals	Pickling	2000 G	1	30	N
U134 (MIXED)	Concentrated aqueous solution of other organics	Discarding of off-spec material	1 T	DK	DK	N
U134 (MIXED)	Waste oil	Clean out of process equipment	980 G	0	1	N
U134 (MIXED)	Empty or crushed metal drums or containers	Closure of process equipment	18 T	99	1	N
U134 (MIXED)	Mixed lab packs	Laboratory wastes	1 T	ND	ND	N
U134 (MIXED)	Mixed lab packs	Laboratory wastes	1 T	ND	ND	ND
U134 (MIXED)	Apcd sludge/scrubber water	Flue gas desulfurization/other pollution control	ND	1	98.5	Hydrogen fluoride(500ppm-0.1%)
U135	Inorganic gases	Combustion processes	1138 T	0	DK	N
U135	Concentrated off-spec or discarded product	Discarding of out-of-date products or chemicals	1 T	DK	DK	N
U135	Solidified treatment residue	Other pollution control or waste treatment process	9 T	DK	DK	N
U135	Inorganic gases	Laboratory wastes/ discarding of out-of-date chemicals	0	0	0	N
U135(MIXED)	Other inorganic liquid	Other waste production process	224220 T	P	P	N
U135(MIXED)	Other waste inorganic chemicals	Discarding of out-of-date products or chemicals	1 T	90	DK	N
U160	Concentrated off-spec or discarded product	Other waste production process	1 T	0	0	Methyl ethyl ketone peroxide(25-50%)
U189(MIXED)	Contaminated soil or cleanup residue	Closure of surface impoundments	216000 G	90	10	N

DK - DON'T KNOW
G - GALLONS
N - NONE LISTED
NA - NOT AVAILABLE
ND - NO DATA
P - PRESENT
T - TONS

REFERENCE : USEPA 1986e

Table G-2 P and U Wastes Containing Reactive Listing Constituents

WASTE CODE	WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	QUANTITY	PERCENT SOLIDS	PERCENT WATER	CONSTITUENTS PRESENT IN PERCENTAGE LEVELS
P006(MIXED)	Caustic solution with metals&cyanides	Wastewater treatment	20 T	P	P	Cd(1-10%),As & cmpds,NOS(1-10%), Cyanides,NOS(1-10%)
P009(MIXED)	Mixed lab packs/empty containers	Laboratory wastes/cleanup of spill residues	16 T	DK	DK	N
P015	Metal scale,filings or scrap	Size reduction	1 T	ND	ND	N
P015	Other "dry" ash,slag or thermal residue/metal scale, or scrap	Other waste production process/combustion processes	24 G	99	0	Beryllium & cmpds,NOS(10-25%)
P015	Metal scale,filings or scrap	Other process	120 G	99	NA	Be(75-90%),Cu(1-10%),Ni(1-10%),Zn(1-10%)
P015	Other metal salts/chemicals	Laboratory wastes/discarding of off-spec material	0	99	0	Be(>90%)
P015(MIXED)	Metal scale,filings or scrap	Physical scraping/removing	3 T	99	1	Be(1-10%)
P015(MIXED)	Soil contaminated with organics only/reactive cyanide chemicals	Discarding of out-of-date products or chemicals	2 T	99	DK	N
P015(MIXED)	Mixed lab packs	Other process	8000 G	20	20	N
P015(MIXED)	Metal scale,filings or scrap	Size reduction	217 G	95	DK	Be(1-10%),Pb(1-10%),Cyanides(0.1-1%)
P056	Inorganic gases	Discarding of out-of-date products or chemicals	1 T	0	0	Fluorine(>90%)
P056(MIXED)	Other untreated waste	Surface coating	42 G	10	90	Cd(10-25%),Cr(10-25%),Cr+6(1-10%),Fluorine(500ppm-0.1%)
P068	Other inorganic liquid	Discarding of off-spec material	1000 T	0	99	Methyl hydrazine(1-10%)
P068	Other inorganic liquid	Physical scraping or removing/flush rinsing	120 G	DK	DK	Hydrazine(1-10%)
P068(MIXED)	Lab packs of old chemicals only	Laboratory wastes	1 T	NA	NA	N
P068(MIXED)	Other inorganic liquid	Laboratory wastes	100 G	0	95	1,2-Dimethyl hydrazine(1-10%),Methyl hydrazine(1-10%),Hydrazine(1-10%)
P068(MIXED)	Lab packs of debris only	Other waste production process	8 T	99	DK	Hydrazine(0.1-1%),Methyl hydrazine(01.-1%)
P087	Concentrated off-spec or discarded product	Discarding of out-of-date products or chemicals	ND	DK	DK	Osmium tetroxide(>90%)
P087	Other metal salts/chemicals	Discarding of out-of-date products or chemicals	ND	99	NA	Osmium tetroxide(>90%)
P087	Other metal salts/chemicals	Laboratory wastes/ discarding of out-of-date chemicals	1 G	99	0	Osmium tetroxide(>90%)
P087	Concentrated off-spec or discarded product	Laboratory wastes/ discarding of out-of-date chemicals	1 T	DK	DK	Osmium tetroxide(500PPM-0.1%)
P087(MIXED)	Mixed lab packs	Laboratory wastes	90 G	95	4	Osmium tetroxide(0.1-1%),Phenol(0.1-1%),Aniline(0.1-1%)
P087(MIXED)	Mixed lab packs	Laboratory wastes/ discarding of out-of-date chemicals	1 T	P	P	N
P087(MIXED)	Lab packs of old chemicals only	Laboratory wastes	1 T	P	P	N
P105	Concentrated off-spec or discarded product	Discarding of out-of-date products or chemicals	1 T	DK	DK	N
P105	Other metal salts/chemicals	Discarding of out-of-date products or chemicals	1 T	NA	DK	N
P105	Other waste inorganic chemicals	Discarding of out-of-date products or chemicals	1 T	99	0	N
P105	Other reactive salts/chemicals	Laboratory wastes/ discarding of out-of-date chemicals	1 T	99	0	N
P105	Concentrated off-spec or discarded product	Laboratory wastes/ discarding of out-of-date chemicals	1 T	DK	99	N
P105(MIXED)	Caustic sol'n w/metals&cyanides	Laboratory wastes	110 G	DK	DK	N
P105 (MIXED)	Aqueous waste w/low other toxic organics	Distillation and fractionation	1416000 T	6	90	N
P105 (MIXED)	Sediment or lagoon dragout contaminated with organics	Decantation/sedimentation	104 T	40	60	N
P105(MIXED)	Concentrated off-spec or discarded product	Discarding of out-of-date products or chemicals	ND	99	DK	N
P105(MIXED)	Other waste inorganic chemicals	Discarding of out-of-date products or chemicals	1 T	NA	NA	N
P122	Concentrated off-spec or discarded product	Discarding of out-of-date products or chemicals	1 T	DK	DK	Zn(10-25%), Zinc phosphide(10-25%)
P122	Other reactive salts/chemicals	Discarding of out-of-date products or chemicals	1 T	100	ND	Zinc phosphide(75-90%),
P122	Inorganic gases	Laboratory wastes/ discarding of out-of-date chemicals	1 G	99	0	Zn(75-90%), Zinc phosphide(>90%)
U023	Halogenated solvent	Laboratory wastes/ discarding of out-of-date chemicals	2 G	0	0	Benzotrichorlde(>90%)
U023	Aqueous waste w/low other toxic organics	Cleanup of spill residues	148745 G	5	95	N
U023(MIXED)	Cont. Soil or cleanup residue	Cleanup of spill residues	1 T	99	0	N
U096(MIXED)	Other organic liquid	Discarding of out-of-date products or chemicals	180 G	5	95	N
U096(MIXED)	Other "dry" ash,slag or thermal residue	Other pollution control or waste treatment process	18 T	95	5	N
U096(MIXED)	Other "dry" ash,slag or thermal residue	Other pollution control or waste treatment process	18 T	95	5	N
U096(MIXED)	Reactive organic solid	Other waste production process	18 T	ND	ND	Methyl ethyl ketone peroxide(10-25%)
U098	Other organic liquid/contaminated off-spec or discarded product	Discarding of out-of-date products or chemicals	1 T	DK	DK	1,2-Dimethylhydrazine(>90%)
U098	Nonhalogenated solvent	Laboratory wastes/ discarding of out-of-date chemicals	8 G	0	0	1,1-Dimethylhydrazine(>90%)
U098	Wastewater or aqueous mixture	Other waste production process	44 T	0	95	1,1-Dimethylhydrazine(0.1-1%),Methanol(1-10%)
U099	Other organic liquid	Laboratory wastes	1 G	0	0	1,2-Dimethylhydrazine(10-25%)
U103	Spent acid w/metals	Other process	16380 G	ND	ND	N
U103	Nonhalogenated solvent	Laboratory wastes/ discarding of out-of-date chemicals	1 G	0	0	Dimethyl sulfate(>90%)
U103(MIXED)	Spent acid w/metals	Dip rinsing/electroplating	110 G	3	45	N
U109	Lab packs of old chemicals only	Laboratory wastes/ discarding of out-of-date chemicals	1 G	99	0	1,2-Diphenylhydrazine(>90%)
U133	Reactive or polymerizable organic liquid/organic gases	Discarding of off-spec material	1 T	NA	DK	N
U133	Other organic liquid	Discarding of out-of-date products or chemicals	220 G	0	40	Hydrazine(25-50%)

TABLE G-1 (CONTINUED)

Waste code	*Chemical constituent*	*Structure*	*Molecular weight*
U133	**Hydrazine**	$H_2N—NH_2$	**32.1**
U134	**Hydrogen Fluoride**	$H—F$	**20.1**
U135	**Hydrogen Sulfide**	$H—S$	**34.1**
U160	**Methyl Ethyl Ketone Peroxide**	$CH_3CH_2—C—O—O—CH_3$	**88.0**
U189	**Phosphorus Sulfide**	P_2S_5	**222.3**

TABLE G-1 (CONTINUED)

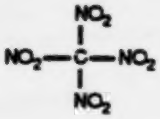
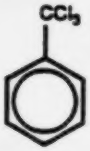
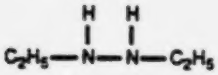
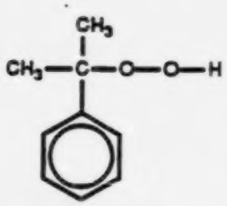
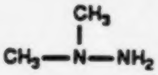
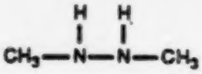
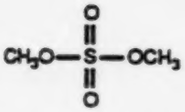
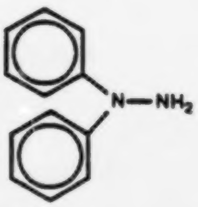
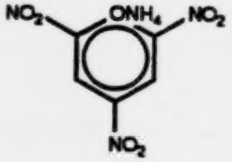
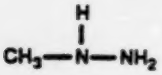
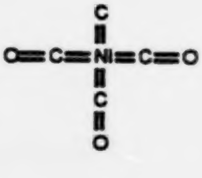
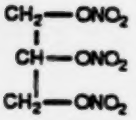
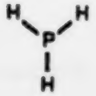
Waste code	*Chemical constituent*	*Structure*	*Molecular weight*
P112	**Tetranitromethane**	 $NO_2-\overset{NO_2}{\underset{NO_2}{C}}-NO_2$	**196.0**
P122/U249	**Zinc Phosphide**	Zn_3P_2	**258.1**
U023	**Benzotrichloride**		**195.5**
U086	**1,2-Diethylhydrazine**	 $C_2H_5-\overset{H}{N}-\overset{H}{N}-C_2H_5$	**88.2**
U096	**a,a-Dimethylbenzyl-hydroperoxide**		**152.1**
U098	**1,1-Dimethylhydrazine**	 $CH_3-\overset{CH_3}{N}-NH_2$	**60.1**
U099	**1,2-Dimethylhydrazine**	 $CH_3-\overset{H}{N}-\overset{H}{N}-CH_3$	**60.1**
U103	**Dimethyl Sulfate**	 $CH_3O-\overset{O}{\underset{O}{S}}-OCH_3$	**126.1**
U109	**Diphenylhydrazine**		**184.2**

TABLE G-1 CHEMICAL STRUCTURES FOR REACTIVE P AND U LISTING CONSTITUENTS

Waste code	***Chemical constituent***	***Structure***	***Molecular weight***
P006	**Aluminum phosphide**	$Al{-}P$	**58.0**
P009	**Ammonium picrate**		**246.1**
P015	**Beryllium dust**	Be	**9.0**
P056	**Fluorine**	F_2	**38.0**
P068	**Methyl hydrazine**	 $CH_3{-}\overset{\overset{\displaystyle H}{\vert}}{N}{-}NH_2$	**46.1**
P073	**Nickel carbonyl**		**170.7**
P081	**Nitroglycerin**		**227.1**
P087	**Osmium tetroxide**	OsO_4	**254.2**
P096	**Phosphine**		**34.0**
P105	**Sodium azide**	$Na{-}N{-}N{\equiv}N$	**65.0**

APPENDIX G

WASTE CHARACTERIZATION, INDUSTRIAL DESCRIPTIONS, AND ANALYTICAL PROBLEMS ASSOCIATED WITH WASTES CONTAINING P AND U REACTIVE LISTING CONSTITUENTS

PERCENT WASTE CODE COMPRISING BATCH RUN AND RESULTING NONWASTEWATER T-CN CONCENTRATION FOR FEB. 12 to MAR. 23, 1987 CYANIDE TREATMENTS

RUN NO.	F006	F007	F008	F009	F011	F012	D002	D003	P029	P030	P106	P121	TREATED FILTERCAKE mg/Kg T-CN
1	—	13.3	1.1	16.4	—	17	17.8	15.9	—	11.9	6.6	—	479
2	—	7.7	—	15.4	—	—	21.5	24.6	—	13.6	17.2	—	204
3	16.2	11.9	—	29.3	—	—	1.8	11.6	—	—	29.2	—	471
4	12.5	48.4	3.9	9.2	—	—	—	24	1.1	0.6	0.3	—	501
5	6.1	19.1	—	30.8	4.1	4.6	13.5	11.1	—	0.3	10.4	—	315
6	3.3	17.2	—	16.0	4.2	4.5	27.4	11.9	—	—	10.2	5.3	328
7	3.3	29.5	—	19.1	3.4	—	27.2	12.2	—	—	—	5.4	226
8	5.5	22.5	2.9	16	4.1	29.8	—	13.2	—	—	—	6.0	254
9	8.5	13.7	3.0	16.7	4.2	3.0	31	13.7	—	—	—	6.2	143
10	3.1	5.5	—	50.6	—	4.1	31.8	0.3	3.7	0.9	—	—	192
11	—	5.9	—	54.1	—	0.7	34	0.4	4.0	0.9	—	—	153
12	—	6.2	5.6	4.3	1.6	—	37.2	30.1	—	15	—	—	338
13	—	6.2	5.6	4.3	1.6	—	37.2	30.1	—	1.5	—	—	273
ean	4.5%	15.9%	1.7%	21.7%	1.8%	4.9%	21.6%	15.3%	0.7%	4.5%	5.6%	1.8%	298 mg/Kg

UNTREATED D003 WASTES RECEIVED

DATE TREATED			WASTE DESCRIPTION					
YEAR	MONTH	DAY	EPA CODE	I.D. NO.	VOL. GAL.	PHYSICAL STATE	T-CN mg/Kg	T-Fe mg/Kg
1987	FEB.	12	D003	3937	110	POWDER	111,364	11,000
		16	D003	3575	3135	Filt'd Solid	6,100	7,500
		17	D003	2652	1375	Rock-LIKE SOLIDS	173,750	2,652
		17	D003	4215	55	DRY SOLID	1,000	10,300
		18	D003	1844	1760	Filt'd SOLID	61,111	47,250
		24	D003	4256	165	NaCN SOLN	83,333	4,256
		25	D003	1556	4578	LIQUID	3,124	910
	MAR.	5	D003	1600	5000	LIQ. W/S.S.	5,300	1,550
		17	D003	4174	110	LIQUID	79,545	550
		19	D003	4009	55	SOLIDS	< 100	4,060
		20	D003	4297	990	DRY DUST	40,000	4,680
		20	D003	1600	5000	LIQUID	3,640	1,240
		23	D003	4466	2255	CLEAR LIQ.	330	<100
		24	D003	4524	55	SOLIDS	82,500	3,530
		24	D003	4528	55	SOLIDS	65,000	3,000
		26	D003	3575	1320	SOLIDS	83,000	4,500
				MEAN	1626		49,950	6,692
1989	JUL.	22	D003	4078	1210	SLUDGE	5,455	4,170
		24	D003	11036	660	LIQUID	150,000	1,000
	AUG.	1	D003	9504	4000	SOLIDS	85,294	1,414
	SEP.	20	D003	11415	715	SOLID	17,500	36,250
		21	D003	3049	2860	CRYST.	10,227	2,530
		26	D003	11794	3000	LIQUID	20,227	91
		29	D003	11094	935	SOLIDS	34,821	12,500
	OCT.	17	D003	3047	3795	CRYST.	10,833	6,750
		30	D003	1556	5000	LIQUID	12,667	675
				MEAN	2463		38,558	7,264

Comparison of Raw Waste Cyanide and Iron Content on Treated Non-wastewater Cyanide Concentration for D003 vs. Listed Electropating Waste Codes

Feb. 12 to Mar. 26, 1989
D003 and Electroplating Code
Cyanide Batch Treatments

EPA Waste Code	Vol.% of Total Batch	Untreated Waste Composition Avg. T-CN mg/Kg	Untreated Waste Composition Avg. T-Fe mg/Kg
F006	4.5	263	12,965
F007	15.9	23,585	613
F008	1.7	16,906	12,535
F009	21.7	32,787	13,019
D003	15.3	49,950	6,692
	Total Vol.%	Volume Weighted Avg. T-CN mg/Kg	Volume Weighted Avg. T-Fe mg/Kg
	59.1%	18,519	4,742
Avg. Treated Filter Cake at 44 Wt.% Solids		T-CN mg/Kg	T-Fe mg/Kg
		298	50,000

Typical July 24 to Oct. 30, 1989 D003
Cyanide Waste Batch Treatments

	Avg. Vol.% of Total Batch	Waste Stream I.D. Number	Untreated Waste Composition T-CN mg/Kg	Untreated Waste Composition T-Fe mg/Kg	Treated Filter Cake T-CN mg/Kg	Treated Filter Cake CN(A) mg/Kg
	11	4,078	5,455	4,170	438	<1.0
	6	11,036	150,000	1,000	516	<1.0
	36.4	9,505	85,294	1,414	469	<1.0
	6.5	11,415	17,500	36,250	371	<1.0
	26	3,049	10,277	2,530	281	<1.0
	27.3	11,798	20,227	91	436	<1.0
	8.5	11,094	34,821	12,500	342	29.0
	34.5	3,047	10,833	6,250	500	<1.0
	45.5	1,556	12,667	675	529	<1.0
Mean	22.4	---	38,558	7,209	431	<4.0

APPENDIX F

WASTE CHARACTERIZATION DATA FOR D003 CYANIDE WASTES

Note 3: A liquid monopropellant fuel is defined as any propellant in which the fuel and the oxidizer are physically or chemically combined in one form.

Note 4: Smokeless powder for small arms in quantities not to exceed 100 pounds net weight in one car or motor vehicle, except shipments by, for, or to the Department of the Army, Navy, or Air Force of the United States Government, shall be classed as a flammable solid for purposes of transportation when packaged in accordance with § 173.197a.

(h) Starter cartridges, jet engine, Class B explosives, consist of plastic and/or rubber cases, each containing a pressed cylindrical block of propellant explosive and having in the top of the case a small compartment that encloses an electrical squib, small amounts of black powder, and smokeless powder, which constitutes an igniter. The starter cartridge is used to activate a mechanical starter for jet engines.

(i) Rocket engine (liquid), Class B explosives, is a complete, self-contained rocket propulsion unit that contains an oxidizer and a fuel, each separated by an aluminum or stainless steel wall of not less than 0.250-inch thickness. Double walls are permitted. Pressurization of the propellant tanks is by use of a gas generator. The ignition source must be in an unarmed position for shipment. Rocket engines (liquid) are used to propel or provide thrust for rockets, missiles, or spacecraft.

(i) A rocket motor to be considered "nonpropulsive" must be capable of unrestrained burning and will not move appreciably in any direction when ignited by any means. Blast deflectors, thrust neutralizers, or other similar devices must be proven by test prior to authorization for use.

(ii) Rocket motors, Class B explosives, may be shipped in a propulsive state only under conditions approved by the Department of Defense or the National Aeronautics and Space Administration.

(3) Igniters, jet thrust (jato), Class B explosives, and igniters, rocket motor, Class B explosives, are devices consisting of an electrically operated or remotely controlled ignition element and a fast burning composition which functions by rapid burning rather than detonation, assembled in a unit for use in igniting the propelling charge of jet thrust units, rocket motors, or rocket engines.

(f) Propellant explosives, Class B, are solid or liquid chemicals or chemical mixtures that function by combustion. The combustion is controlled by composition, size, form of grain, or other chemical or mechanical means. Any propellant is Class B that fails to detonate in five trials when tested (see Note 2) in the package in which it is offered for shipment. Propellant explosives, Class B, include smokeless powder for small arms (see Note 4), smokeless powder for cannon, liquid monopropellant fuel (see Note 3), smokeless powder, or solid propellant explosives for rockets, jet thrust units, or other devices. Black powder is not included in this classification and is defined specifically in §173.53.

(g) Explosives power devices, Class B, are devices designed to operate ejecting apparatus or other mechanisms by means of a propellant explosive, Class B, and differ from explosive power devices, Class C, in that they contain larger or more powerful propellants. The devices must not rupture on functioning and must be of a type examined by the Bureau of Explosives and approved by the Director, OHMT, except as otherwise provided in §173.51(b) and §173.86(a).

Note 1: Fire-extinguisher charges containing not to exceed 50 grains of propellant explosives per unit are exempt from the regulations in Parts 170-189 of this chapter.

Note 2: In conducting the test, one propellant container shall be surrounded by inert loaded containers of the same weight, including one inert container placed on top of the propellant container. The propellant shall be ignited by means of a commercial electric squib placed within 4 inches of the bottom of the container. The presence of a crater and absence of flame shall be considered as evidences of detonation.

(d) Special fireworks are manufactured articles designed primarily for the purpose of producing visible or audible pyrotechnic effects by combustion or explosion. (See §173.100(r) for common fireworks.) Examples are toy torpedoes, railway torpedoes, some firecrackers and salutes, exhibition display pieces, aeroplane flares, illuminating projectiles, incendiary projectiles, incendiary bombs or incendiary grenades, and smoke projectiles or smoke bombs fuzed or unfuzed and containing expelling charges but without bursting charges, flash powders in inner units not exceeding 2 ounces each, flash sheets in interior packages, flash powder or spreader cartridges containing not over 72 grains of flash powder each (see § 173.60 for shipments made as low explosives) and flash cartridges consisting of a paper cartridge shell, small-arms primer, and flash composition, not exceeding 180 grains all assembled in one piece. Fireworks must be in a finished state, exclusive of mere ornamentation, as supplied to the retail trade and must be so constructed and packed that loose pyrotechnic composition will not be present in packages in transportation.

(e) Jet thrust units (jato), Class B explosives; rocket motors, Class B explosives; igniters, jet thrust (jato), Class B explosives; and igniters, rocket motors, Class B explosives:

(1) Jet thrust units (jato), Class B explosives, are metal cylinders containing a mixture of chemicals capable of burning rapidly and producing considerable pressure. Jet thrust units are designed to be ignited by an electric igniter. They are used to assist aeroplanes to take off.

(2) Rocket motor, Class B explosives, is a device containing a propelling charge and consisting of one or more continuous type combustion unit(s), closed at one end (closure may be an igniter with a thrust plate) and with a nozzle(s) at the other end. The propelling charge consists of a mixture of chemicals and/or chemical compounds which when ignited is capable of burning rapidly and producing considerable pressure and which will not sustain a detonation. (The rocket motor carries its own solid oxidizer-fuel combination.) Rocket motors, Class B explosives, should be nonpropulsive in shipment (see paragraphs (e)(2)(i) and (ii) of this section). Rocket motors, Class B explosives, are designed to be ignited by an electrically actuated device that may be an igniter, or by other means. They are used to propel and/or provide thrust for guided missiles, rockets, or spacecraft.

Note 5: See § 173.100(gg) for criteria that determine whether a particular type of detonator can be classed as a Class C explosive.

Note 6: See § 173.100(hh) for criteria that determine whether a particular type of detonating primer can be classed as a Class C explosive.

Class B explosives include the following:

§ 173.87 Explosives in mixed packaging.

Unless specifically authorized by Parts 110-189 of this subchapter, explosives may not be packed in the same outside packaging with other articles. Inside packages of different explosives (except detonators and initiating explosives) may be packed in one outside packaging in accordance with the requirements of this subchapter if the gross weight of each inside package does not exceed 8 ounces and the gross weight of the completed package does not exceed 50 pounds.

(a) Explosives, Class B, are defined as those explosives that in general function by rapid combustion rather than detonation and include some explosive devices such as special fireworks, flash powders, some pyrotechnic signal devices, and liquid or solid propellant explosives, which include some smokeless powders. These explosives are further described in paragraphs (b) to (g) of this section.

(b) Ammunition for cannon with empty projectiles, inert-loaded projectiles, solid projectiles or without projectiles, or shell, and catapult charges exceeding 2 inches in diameter, is fixed ammunition assembled in a unit consisting of the cartridge case containing the propelling charge and primer with empty, inert-loaded, or solid projectiles, or without projectiles, which is fired from a cannon, mortar, gun, howitzer, or recoilless rifle.

(c) Rocket ammunition is fixed ammunition that is fired from a tube, launcher, rails, trough, or other device as distinguished from cannon ammunition, which is fired from a cannon, gun, or mortar. It consists of an igniter, a rocket motor, empty projectile, an inert-loaded projectile, or a solid projectile.

primacord. Shaped charges must be of a type described in paragraph (h)(1) of this section, except that each shaped charge installed in the steel tube or metallic strip shall contain not over 4 ounces of high explosive. Charged well casing jet perforating guns must not be transported with blasting caps, electric blasting caps, or other firing devices affixed to or installed in the guns.

(v) Type 9. Propellant explosives, Class A, are solid chemicals or solid chemical mixtures that are designed to function by rapid combustion of successive layers, generally with little or no smoke. The combustion is controlled by composition, size, and form of grain. Propellant explosives, Class A, include some types of smokeless powder and some types of solid propellant explosives for jet thrust units, rockets, or other devices. Any propellant explosive is Class A which detonates in any one out of five trials when tested in the packages in which it is offered for transportation. In conducting the test, one propellant container shall be surrounded by inert loaded containers of the same weight, including one inert container placed on top of the propellant container. The propellant shall be ignited by means of a commercial electric squib placed within 4 inches of the bottom of the container. The presence of a crater and absence of flame shall be considered as evidences of detonation.

(w) Detonating cord is a device consisting of a core of pentaerythrite tetranitrate, cyclotrimethylene-trinitramine, or similar explosive overspun with tapes, yarns, and plastics or waterproofing compounds without wire countering.

FOOTNOTES

Note 1: The detonation test is performed by placing the sample in an open-end fiber tube that is set on the end of a lead block approximately 1-1/2 inches in diameter and 4 inches high, which, in turn, is placed on a solid base. A steel plate may be placed between the fiber tube and the lead block.

Note 2: A No. 8 test blasting cap is one containing 2 grams of a mixture of 80 percent mercury fulminate and 20 percent potassium chlorate, or a cap of equivalent strength.

Note 3: "Unconfined," as used in this section, does not exclude the use of a paper or soft fiber tube wrapping to facilitate tests.

Note 4: The Bureau of Explosives Impact Apparatus is a testing device designed so that a guided 8-pound weight may be dropped from predetermined heights so as to impact specific quantities of liquid or solid materials under fixed conditions. Detailed prints may be obtained from the Bureau of Explosives, 1920 L Street, N.W., Washington, D.C. 20036.

(1) Jet thrust units (jato), class A explosives, are metal cylinders containing a mixture of chemicals capable of burning rapidly and producing considerable pressure. Under certain conditions, the chemical fuel with which the unit is loaded may explode. Jet thrust units are designed to be ignited by an electric igniter. They are used to assist aeroplanes to take off.

(2) Rocket motor, Class A explosives, is a device containing a propelling charge and consisting of one or more continuous type combustion unit(s) closed at one end (closure may be an igniter with a thrust plate) and with a nozzle(s) at the other end. (The rocket motor carries its own solid oxidizer-fuel combination.) The propelling charge consists of a mixture of chemicals and/or chemical compounds which, when ignited, is capable of burning rapidly and producing considerable pressure and which will sustain a detonation. Rocket motors, Class A explosives, should be nonpropulsive in shipment (see paragraphs (t)(2)(i) and (ii) of this section). Rocket motors, Class A explosives, are designed to be ignited by an electrically actuated device that may be an igniter, or by other means. They are used to propel and/or provide thrust for guided missiles, rockets, or spacecraft.

(i) A rocket motor to be considered "nonpropulsive" must be capable of unrestrained burning and will not move appreciably in any direction when ignited by any means. Blast deflectors, thrust neutralizers, or other similar devices must be proven adequate by test prior to authorization for use.

(ii) Rocket motors, Class A explosives, may be shipped in a propulsive state only under conditions approved by the Department of Defense.

(3) Igniters, jet thrust (jato), Class A explosives, and igniters, rocket motors, Class A explosives, are devices consisting of an electrically operated or remotely controlled ignition element and a charge of fast-burning composition meeting the definition prescribed for Type 1 Class A explosives (see paragraph (a) of this section), assembled in a unit for use in igniting the propelling charge of jet thrust units or rocket motors.

(u) Charged well casing jet perforating guns. Charged well casing jet perforating guns are steel tubes or metallic strips into which are inserted shaped charges connected in series by

(n) Explosive mines. Explosive mines are metal or composition containers filled with a high explosive.

(o) Explosive torpedoes. Explosive torpedoes, such as are used in warfare, are metal devices containing a means of propulsion and a quantity of high explosives.

(p) Rocket ammunition. Rocket ammunition (including guided missiles) is ammunition designed for launching from a tube, launcher, rails, trough, or other launching device, in which the propellant material is a solid propellant explosive. It consists of an igniter, rocket motor, and projectile (warhead) either fuzed or unfuzed, containing high explosives or chemicals. Rocket ammunition may be shipped completely assembled or may be shipped unassembled in one outside container.

(q) Ammunition for small arms with explosive projectiles or incendiary projectiles. Ammunition for small arms with explosive projectiles and ammunition for small arms with incendiary projectiles is fixed ammunition of caliber 20 millimeters to be used in machine guns or cannons, and consists of a metallic cartridge case, the primer and the propelling charge, with explosive projectile or incendiary projectile with or without detonating fuze; the component parts necessary for one firing being all in one assembly. Detonating fuzes, tracer fuzes, explosive or ignition devices, or fuze parts with explosives contained therein must not be assembled in ammunition or included in the same outside package unless shipped by, for, or to the Departments of the Army, Navy, and Air Force of the U.S. Government or unless of a type approved by the Department.

(r) Chemical ammunition. Chemical ammunition used in warfare is all kinds of explosive chemical projectiles, shells, bombs, grenades, etc., loaded with toxic, tear, or other gas, smoke or incendiary agent; also such miscellaneous apparatus as cloud-gas cylinders, smoke generators, etc., that may be utilized to project chemicals.

(s) Boosters, bursters, and supplementary charges. Boosters and supplementary charges consist of a casing containing a high explosive and are used to increase the intensity of an explosion of the detonator of a detonating fuze. Bursters consist of a casing containing a high explosive and are used to rupture a projectile or bomb to permit release of its contents.

(t) Jet thrust units (jato), Class A explosives; rocket motors, class A explosives; igniters, jet thrust (jato), Class A explosives; and igniters, rocket motor, Class A explosives.

(h) Type 8. Any device or solid or liquid compound or mixture that is not specifically included in any of the above types, and which under special conditions may be so designated and examined by the Bureau of Explosives or the Bureau of Mines, U.S. Department of the Interior, and approved by the Director, OHMT. Example: Shaped charges, commercial.

(1) A shaped charge, commercial, consists of a plastic, paper, or other suitable container composed of a charge of not to exceed 8 ounces of a high explosive containing no liquid explosive ingredient and with a hollowed-out portion (cavity) lined with a rigid material. Detonators or other initiating elements may not be assembled in the device unless examined by the Bureau of Explosives and approved by the Director, OHMT.

(i) Ammunition for cannon. Ammunition for cannon is fixed, semifixed, or separate loading ammunition that is fired from a cannon, mortar, gun howitzer, or recoilless rifle.

(j) Ammunition for cannon with projectiles. Ammunition for cannon with explosive projectiles, gas projectiles, smoke projectiles, incendiary projectiles, illuminating projectiles, or shell is fixed ammunition assembled in a unit consisting of the cartridge case containing the propelling charge and primer, and the projectiles, or shell, fuzed or unfuzed. Detonating fuzes, tracer fuzes, explosive or ignition devices, or fuze parts with explosives contained therein may not be assembled in ammunition or included in the same outside package unless shipped by or for the Department of Defense (DOD) and in accordance with established practices and procedures specified by DOD.

(k) Explosive projectiles. Explosive projectiles are shells, projectiles, warheads, or rocket heads, loaded with explosives or bursting charges, with or without other materials, for use in cannons, guns, tubes, mortars, or other firing or launching devices.

(l) Grenades. Grenades, hand or rifle, are small metal or other containers designed to be thrown by hand or projected from a rifle. They are filled with an explosive or a liquid, gas, or solid material such as a toxic or tear gas or an incendiary or smoke producing material and a bursting charge. When shipped without explosives or bursting charges, see §§ 173.100(6), 173,330, 173.350, and 173.385.

(m) Explosive bombs. Explosive bombs are metal or other containers filled with explosives. They are used in warfare and include aeroplane bombs and depth bombs.

- Blasting caps that are activated by a safety fuse.
- Blasting caps that are percussion activated.
- Blasting caps that are activated by flexible detonating cord, including:

(A) Delay connectors in plastic sheaths, which consist of a plastic sleeve that contains a suitable delay system with receptor and donor explosive charges in the center portion. Each end of the sleeve is made so that flexible detonating cord can be inserted into and locked to the connector.

(B) Delay connectors in metal tubes, which consist of a system with a receptor and donor charge positioned between two detonators, with the entire assembly placed in a metal tube having both ends open for the insertion of flexible detonating cord.

(C) Delay connectors with detonating cord pigtails, which consist of delay connectors as described in paragraph (g)(1)(iii)(B) of this section that have short lengths of detonating cord inserted into both ends and crimped in place.

(D) Nonelectric instantaneous and delay caps, which consist of blasting caps to which is assembled a length of detonating cord that may have a transfer explosive charge at the opposite end.

- Blasting caps that are activated by gas pressurization or reaction.
- Blasting caps that are activated by a shock tube.
- Electric blasting caps that are activated by an electric current.

(2) A detonating primer (see Note 6) is an initiation device for commercial use that contains more than 10 grams of total explosives weight, excluding ignition and delay charges per unit.

(3) Detonating fuzes, Class A, are used in the military service to detonate the high explosive bursting charges of projectiles, mines, bombs, torpedoes, and grenades. In addition to a powerful detonator, they may contain several ounces of a high explosive, such as tetryl or dry nitrocellulose, all assembled in a heavy steel envelope. They may also contain a small amount of radioactive component. Those that are made and packed so that they will not cause functioning of other fuzes, explosives, or explosive devices in the same or adjacent containers are classed as Class C explosives.

(c) Type 3. Solid explosives that contain no liquid explosive ingredient and which can be detonated, when unconfined (see Note 3), by means of a No. 8 test blasting cap (see Note 2); or which can be exploded in at least 50 percent of the trials in the Bureau of Explosives' Impact Apparatus (see Note 4) under a drop of 4 inches or more, but cannot be exploded in more than 50 percent of the trials under a drop of less than 4 inches. Example: High explosives, commercial dynamite containing no liquid explosive ingredient, trinitrotoluene, amatol, tetryl, picric acid, urea nitrate, pentolite, and commercial boosters.

(d) Type 4. Solid explosives that can be caused to detonate when unconfined (see Note 3), by contact with sparks or flame such as are produced by a safety fuse or an electric squib; or which can be exploded in the Bureau of Explosives' Impact Apparatus (see Note 4), in more than 50 percent of the trials under a drop of less than 4 inches. Example: Initiating and priming explosives, lead azide, fulminate of mercury, etc., and high explosives.

(e) Type 5. Desensitized liquid explosives that can be detonated separately or when absorbed in sterile absorbent cotton, by a No. 8 test blasting cap (see Note 2); but which cannot be exploded in the Bureau of Explosives' Impact Apparatus (see Note 4), by a drop of less than 10 inches. The desensitizer must not be significantly more volatile than nitroglycerine, and the desensitized explosive must not freeze at temperatures above minus °F. Example: High explosives, desensitized nitroglycerine.

(f) Type 6. Liquid explosives that can be exploded in the Bureau of Explosives' Impact Apparatus (see Note 4), under a drop of less than 10 inches. Example: Nitroglycerin. (See § 173.51(a)(3).)

(g) Type 7. An initiating device that is a metal or plastic casing containing initiating or priming explosives, Class A-Type 4, either with or without other explosives. It is activated by any one of several means, including an electrical pulse, a flame, a shock or detonation wave, mechanical impact (percussion) pressurized gas, or a high intensity light beam. It produces an explosive output that may be used to initiate another explosive or to perform work. A time delay may be incorporated in the means of applying the stimulus or in the initiating device itself.

(1) A detonator (see Note 5) is an initiating device (other than one properly described as a detonating fuze) that contains no more than 10 grams of total explosives weight, excluding ignition and delay charges per unit. The different kinds of detonators include the following:

Forbidden explosives include the following:

1. Explosive compounds, mixtures, or devices that ignite spontaneously or undergo marked decomposition when subjected to a temperature of 167°F (75°C) for 48 consecutive hours.
2. New explosive compounds, mixtures, or devices except as provided for in §173.86.
3. Explosive mixtures or devices containing an ammonium salt and a chlorate.
4. Explosive mixtures or devices containing an acidic metal salt and a chlorate.
5. Leaking or damaged packages of explosives.
6. Nitroglycerin, diethylene glycol dinitrate, or other liquid explosives not authorized by §173.53(e).
7. Loaded firearms.
8. Fireworks that combine an explosive and a detonator or blasting cap.
9. Fireworks containing yellow or white phosphorus.
10. Toy torpedoes, the maximum outside dimension of which exceeds 7/8-inch, or toy torpedoes containing a mixture of potassium chlorate, black antimony, and sulfur, with an average weight of explosive composition in each torpedo exceeding four grains.

Class A explosives include the following:

(a) Type 1. Solid explosives that can be caused to deflagrate by contact with sparks or flame such as are produced by a safety fuse or an electric squib, but cannot be detonated (see Note 1) by means of a No. 8 test blasting cap (see Note 2). Example: Black powder and low explosives.

(b) Type 2. Solid explosives that contain a liquid explosive ingredient, and which, when unconfined (see Note 3), can be detonated by means of a No. 8 test blasting cap (see Note 2); or which can be exploded in at least 50 percent of the trials in the Bureau of Explosives' Impact Apparatus (see Note 4) under a drop of 4 inches or more, but cannot be exploded in more than 50 percent of the trials under a drop of less than 4 inches. Example: High explosives, commercial dynamite containing a liquid explosive ingredient.

APPENDIX E

DEFINITIONS OF FORBIDDEN EXPLOSIVE, CLASS A EXPLOSIVE, AND CLASS B EXPLOSIVE ACCORDING TO 49 CFR

Table D-8 Characterization Data for D003 Other Reactives Subcategory

WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	INDUSTRIAL DESCRIPTION	PERCENT SOLIDS	PERCENT WATER
Halogenated/Nonhalogenated Solvent mixture	Heavy ends/still bottoms removal	Industrial organic chemicals, nec, agricultural chemicals, nec	NA	0
Other halogenated organic solid	Clean out of process equipment	Abrasive products,misc. plastics products,petroleum and coal prod, nec	DK	DK
Other organic sludge	Halogenation	Industrial organic chemicals, nec	DK	0
Reactive or polymerizable organics	Halogenation	Industrial organic chemicals, nec	2	0
	Halogenation	Industrial organic chemicals, nec	1	0
Still bottoms of halogenation solvents/organics	Distillation & fractionation	Industrial organic chemicals, nec	2	0

DK - DON'T KNOW
NA - NOT AVAILABLE

REFERENCE : USEPA 1988e

Table D-7 Characterization Data for D003 Reactive Sulfide Subcategory

WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	INDUSTRIAL DESCRIPTION	SOLIDS (%)	WATER (%)	SULFIDE (PPM)	CONSTITUENTS PRESENT IN PERCENTAGE LEVELS
Acidic aqueous waste	Electroplating	Commercial printing, gravure	2	98	100	N
Aqueous waste with reactive sulfides	Decantation/sedimentation	Petroleum refining	DK	98	43000	H2S(0.1-1%)
	Air & steam stripping	Industrial inorganic chemicals, nec	10	90	10000	N
	Distillation & fractionation	Petroleum refining	(1*)	90	7180	N
	Inorganic aqueous reactions	Leather tanning and finishing	5(1*)	95	4000	N
	Distillation & fractionation	Petroleum refining	2	98	2500	N
	Flue gas desulfurization	Petroleum refining	10	85	1270	N
	Closure of process equipment	Industrial inorganic chemicals, nec	0	99	3	N
	Clean out of process equipment	Industrial organic chemicals, nec	5	95	NA	Carbon disulfide(0.1-1%)
	Reaction/synthesis media processing	Industrial organic chemicals, nec	1	98	10000	H2S(0.1-1%)
	Other one-time process	Industrial organic chemicals, nec	10	90	6000	N
	Other waste production process	Petroleum refining	0.4	98	3875	Phenol(500ppm-1%)
	Solvent extraction	Petroleum refining	12	86	500	H2S(500ppm-0.1%)
	Other process	Electronic computing equipment	DK	DK	10	N
	Reaction/synthesis media processing	Industrial organic chemicals, nec	DK	DK	2	N
Caustic aqueous waste	Clean out of process equipment	Petroleum refining	P	99	1270	N
Lab packs of old chemicals only	Laboratory wastes	Research and development laboratories	10	1	200	Ethyl ether(25-50%), Ethylene glycol monoethyl ether(10-25%), Ethyl methacrylate(10-25%)
Metal scale, filings or scrap	Clean out of process equipment	Industrial organic chemicals, nec	99	1	31	N
Mixed lab packs	Discarding of out of date products or chemicals	Cyclic crudes and intermediates	80	DK	10000	Cr(total)(0.1-1%), Cr(hexav)(0.1-1%)
Other inorganic liquid	Laboratory wastes	Colleges and universities, nec,gen. medical and surgical hospitals	P	98	1000	Cyanides(500ppm-0.1%)
	Other waste production process	Blast furnaces and steel mills	P	98	220	Cyanides(500ppm-0.1%)
	Pyrolysis	Blast furnaces and steel mills	1	99	120	N
	Other process	Primary aluminum	DK	99	113	N
Other inorganic solids	Cleanout of process equipment	Petroleum refining	60	40	600000	N
	Filtration/centrifuging	Cyclic crudes and intermediates	50	50	46000	N
	Other waste production process	Petroleum refining	98	0	1000	Ni(1-10%),V(10-25%)
	Degreasing sludge with metal scale or filings	Crude petroleum and natural gas, natural gas liquids	100	DK	250	N
	Distillation and fractionation	Crude petroleum and natural gas, natural gas liquids	2	98	100	N
Other nonhalogenated organic solid	Other waste production process	Plastics materials and resins,industrial organic chemicals, nec	99	1	5	N
Other organic liquid	Flue gas desulfurization	Industrial inorganic chemicals, nec	0	90	1000	H2S(500ppm-0.1%)
	Distillation and fractionation	Industrial organic chemicals, nec	1	85	70	N
Other organic sludge	Other clean out or closure process	Cyclic crudes and intermediates	75	25	200	Naphthoquinone(25-50%), Pyridine(1-10%)
Other reactive salts/chemicals	Slag removal	Gray iron foundries	3	0	230	N
Reactive or polymerizable organic liquid	By-product processing	Miscellaneous plastics products	0	20	74	Phthalic acid esters(75-90%)
Reactive organic solid	Other clean out or closure process	Petroleum and coal products, nec	80	20	268000	Cyanides(0.1-1%)
	Gas adsorption	Crude petroleum and natural gas	DK	DK	2.2	N
Reactive sulfide salts/chemicals	Other one-time process	Petroleum refining	90	0	P	Ni(500ppm-0.1%)
	Filtration/centrifuging	Industrial organic chemicals, nec	90	10	NA	H2S(500ppm-0.1%)
	Discarding of out of date products or chemicals	Primary nonferrous metals, nec	98	0	DK	N
	Cleanout of process equipment	Industrial inorganic chemicals, nec	70	30	150000	N
	Tank bottoms removal	Hardware, nec,plating and polishing	80	20	0	Sb(0.1-1%), Cu(500ppm-0.1%),Zn(1-10%)
Resins, tars or tarry sludge	Other cleanout or closure process	Blast furnaces and steel mills	93	5	96	N
Sludge with reactive sulfides	Filtration/centrifuging	Industrial inorganic chemicals, nec	95	5	29000	H2S(1-10%)
	Tank bottoms removal	Cyclic crudes and intermediates	61	34	200	Cresols(1-10%)
Soil contaminated with inorganics only	Cleanup of spill residues	Petroleum refining	100	0	4357	H2S(0.1-1%)
Spent carbon	Other one-time process	Petroleum refining	DK	DK	800	N
	Clean out of process equipment	Petroleum refining	99	1	10	N
	Solvent extraction	Petroleum refining	DK	95	8300	Hydrogen fluoride(0.1-1%), H2S(0.1-1%)

* = SUSPENDED SOLIDS
DK = DON'T KNOW
N = NONE LISTED
NA = NOT AVAILABLE
P = PRESENT

REFERENCE: USEPA 1988e

Table D-6 Characterization Data for D003 Water Reactives Subcategory

WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	INDUSTRIAL DESCRIPTION	PERCENT SOLIDS	PERCENT WATER
Batteries or battery parts,casings or cores	Other process	Motor vehicle parts and access.,automotive stampings	100	NA
	Other process	National security	NA	NA
	Disc. of out-of-date products/chemicals	National security	DK	DK
	DK	National security	P	NA
	Other one-time process	National security	99	DK
	Other process	National security	NA	NA
	Other process	National security	DK	0
	Discarding of out-of-date products or chemicals	National security	99	DK
	Discarding of off-spec material	National security, communication services, nec	100	ND
	Discarding of off-spec material	National security, communication services, nec	100	ND
	Size reduction	Primary batteries, dry and wet	NA	NA
	Discarding of off-spec material	Primary batteries, dry and wet	NA	NA
	Other process	Primary batteries, dry and wet	90	NA
	Discarding of off-spec material	Primary batteries, dry and wet	NA	NA
	Other waste production process	Radio and tv communication equipment	99	NA
	Electrostatic precipitation	Regulation, administration of transportation	90	10
Metal scale, filings or scrap	Laboratory wastes	DK	99	DK
	Size reduction	Primary batteries, dry and wet	NA	NA
	Size reduction	Primary batteries, dry and wet	NA	NA
	Size reduction	Primary batteries, dry and wet	NA	NA
	Size reduction	Research and development laboratories	100	0
Other "dry" ash,slag or thermal residue	Slag removal	Gray iron foundries	100	0
	Slag removal	Gray iron foundries	100	DK
	Slag removal	Primary metal products, nec	100	0
	Slag removal	Industrial inorganic chemicals, nec	99	0
	Slag removal	Industrial inorganic chemicals, nec	99	0
Other metal salts/chemicals	High temperature metal refining	Primary nonferrous metals, nec	100	0
Other treatment residue	Other process	Gray iron foundries	95	5
Reactive organic solid	Discarding of out-of-date products or chemicals	Primary batteries, dry and wet	NA	NA

DK = DON'T KNOW
NA = NOT AVAILABLE

REFERENCE : USEPA 1986a

Table D-5 Characterization Data for D003 Explosives Subcategory

WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	INDUSTRIAL DESCRIPTION	PERCENT SOLIDS	PERCENT WATER	OTHER CONSTITUENTS
Aqueous waste w/other react (eg exp)	Other waste production process	Surgical appliances and supplies	P	P	N
Concentrated off-spec or discarded product	Clean out of process equipment	Ammunition, except for small arms, nec	90	10	N
	Disc. of off-spec material	Explosives	P	P	Nitroglycerin(1-10%),acetone(0.1-1%),xylene(500ppm-0.1%),Pb(1-10%)
	Discarding of off-spec material	Ammunition, exc. for small arms, nec,ordnance and accessories, nec	99	1	Trinitrotoluene(50-75%)
Lab packs of debris only	Discarding of off-spec material	Ammunition, except for small arms, nec	P	NA	N
Other inorganic solids	Other process	Ammunition, exc. for small arms	99	NA	N
	Other process	Ammunition except for small arms, nec,ordnance and accessories	99	1	N
	Other process	Chemical prep., nec,ammunition except for small arms, nec,ordnance	99	1	N
	Discarding of off-spec material	Explosives	84	16	Thiourea(0.1-1%)
	Other waste production process	Explosives	99	1	N
	Other waste production process	Explosives	DK	DK	N
	Other waste production process	Explosives	95	DK	N
	Other waste production process	Explosives	95	DK	N
	Other process	Explosives	4	96	Sb(500ppm-0.1%),Ba(0.1-1%),Pb(0.1-1%)
	Discarding of out-of date chemicals	Gen. government, nec, national security	P	NP	N
	Other process	Small arms ammunition	90	NA	Nitroglycerin(1-10%),dibutylphthalate(0.1-1%),2,4-dinitrotoluene(0.1-1%)
	Other process	Small arms ammunition	99	NA	Sb(500ppm-0.1%),Ba(0.1-1%),Pb(0.1-1%)
	Other process	Small arms ammunition	99	NA	Sb(500ppm-0.1%),Ba(0.1-1%),Pb(0.1-1%)
	Other process	Small arms ammunition,ordnance and accessories, nec	99	DK	N
Other nonhalogenated organic solid	Clean out of process equipment	Explosives	99	NA	Nitroglycerin(25-50%)
	Other waste production process	National security,ammunition except for small arms, nec	NA	0	N
	Materials handling	Small arms ammunition	99	6	Nitroglycerin(10-25%)
	Other process	Small arms ammunition	33	67	N
Other organic liquid	Solvent extraction	Explosives	0	2	2,4-dinitrotoluene(50-75%), dibutylphthalate(10-25%), diphenylamine(1-10%),ethyl acetate(0.1-1%)
	Solvent extraction	Explosives	0	1	Dibutylphthalate(10-25%),nitroglycerin(10-25%),diphenylamine(1-10%),ethyl acetate(1-10%)
	Other cleaning/degreasing process	Ordnance and accessories, nec	NA	NA	N
Other organic sludge	Tank bottoms removal	Ammunition, except for small arms, nec	80	20	N
	Clean out of process equipment	Explosives,nitrogenous fertilizers, fertilizers, mixing only	90	10	Nitroglycerin(0.1-1%)
Other reactive salts/chemicals	Other waste production process	Ammunition, exc. for small arms,nec,iron and steel forgings	NA	NA	N
	Discarding of off-spec material	Ammunition, except for small arms, nec,chemical preparations, nec	80	20	N
	Materials handling	Explosives	96	0	Ba(1-10%),Cu(1-10%), Pb(1-10%), Se(1-10%)
Reactive or polymerizable organic liquid	Other waste production process	Guided missiles and space vehicles,space propulsion units and parts	DK	0	N
	Other waste production process	Guided missiles and space vehicles,space propulsion units and parts	DK	DK	N
Reactive organic solid	Discarding of out-of-date or chemicals	Ammunition except for small arms,small arms ammunition,	100	0	N
	Materials handling	Ammunition, exc. for small arms,nec,ordnance and access	90	10	Trinitrotoluene(50-75%),nitroglycerin(10-25%),diphenylamine(0.1-1%)
	Other waste production process	Ammunition, except for small arms, nec	99	0	Diphenylamine(0.1-1%)
	Other waste production process	Ammunition, except for small arms, nec,small arms ammunition	P	P	N
	Discarding of off-spec material	Explosives	85	15	N
	Discarding of off-spec material	Explosives	P	P	N
	Cleanup of spill residues	Explosives	99	NA	N
	Discarding of contaminated cleanup equipment	Explosives	20	0	N
	Clean out of process equipment	Explosives	99	1	Trinitrotoluene(25-50%)
	Other process	Explosives	100	ND	N
	Discarding of off-spec material	Explosives	95	5	N
	Other process	Guided missiles and space vehicles	100	0	N
	Other waste production process	Guided missiles and space vehicles	NA	NA	N
	Other waste production process	National security, explosives	99	0	N
	By-product processing	Space propulsion units and parts	99	0	N

DK= DON'T KNOW
N=NONE
NA=NOT AVAILABLE
P=PRESENT

REFERENCE : USEPA 1986a

Table D-4 Waste Characterization for D003 Explosives Subcategory

Type of waste	Constituents	General or typical concentration or amount	Comments
PEP	Nitroguanidine	50%	D003
	Nitroglycerin	20%	D003
	Nitrocellulose	20%	D003
	Ethyl Centralite	Trace	D003
	TNT	Trace	D003
	DNT	Trace	D003
	Aluminum Powder	Trace	D003
Waste Propellant	Nitrocellulose	75-80%	D003
	Nitroglycerin	17-22%	D003
	Ethyl Centralite	Trace	D003
Off-Spec TNT	2,4,6-TNT	90-98%	D003
	Various isomers of TNT	Trace	D003
	Isomers of DNT	Trace	D003
	Other various compounds	Trace	D003

Reference: Department of the Army 1984.

Table D-3 (continued)

WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	INDUSTRIAL DESCRIPTION	SOLIDS (%)	WATER (%)	CYANIDE (PPM)	CONSTITUENTS PRESENT IN PERCENTAGE LEVELS
	Filtration/centrifuging	Industrial organic chemicals, nec	DK	DK	300	N
	Other pollution control or waste treatment process	Electronic components, nec	30	70	700	Cyanides(500ppm-0.1%)
Soil contaminated with inorganics only	Cleanup of spill residue	Organic fibers, noncellulosic	98	2	10	Ni(0.1-1%)
	Cleanup of spill residue	Organic fibers, noncellulosic	95	2	10	Sb(500ppm-0.1%),As(0.1-1%),Ba(500ppm-0.1%)
Spent solid filters/adsorbents	Filtration/centrifuging	Organic fibers, noncellulosic	90	NA	10	Ni(500ppm-0.1%)
	Filtration/centrifuging	Organic fibers, noncellulosic	99	1	10	N
	Filtration/centrifuging	Organic fibers, noncellulosic	90	10	10	Ni(500ppm-0.1%)
	Filtration/centrifuging	Organic fibers, noncellulosic	98	NA	10	N
	Electroplating	Semiconductors and related dev.,electron tubes, rec. type, elec. connectors	99	1	2000	N
Wastewater or aqueous mixture	Electroplating	Steel wire and related products	(15*)	85	20000	N
	Electroplating	Steel wire and related products	(15*)	83	20000	Zn(0.1-1%)
	Electroplating	Steel wire and related products	15	85	20000	Sodium cyanide(0.1-1%),copper cyanide(0.1-1%),Zinc cyanide(0.1-1%)
	Electroplating	Steel wire and related products	15	85	20000	Sodium cyanide(0.1-1%),copper cyanide(0.1-1%),zinc cyanide(0.1-1%)

* = SUSPENDED SOLIDS
DK = DON'T KNOW
N = NONE LISTED
NA = NOT AVAILABLE
P = PRESENT

REFERENCE: USEPA 1988a

Table D-3 Characterization Data for D003 Reactive Cyanide Subcategory

WASTE DESCRIPTION	SOURCE OF WASTE GENERATION	INDUSTRIAL DESCRIPTION	SOLIDS (%)	WATER (%)	CYANIDE (PPM)	CONSTITUENTS PRESENT IN PERCENTAGE LEVELS
Aqueous waste with other reactives	Other process	National security	0	90	170	N
	Pickling	Ship building and repairing	DK	DK	DK	N
Caustic solution with cyanides but no metals	Other clean out or closure process	Bolts, nuts, rivets, and washers,plating and polishing	40	5	250	N
	Other one-time process	Research and development laboratories	DK	90	15000	Xylene(0.1-1%)
	Electroplating	Electronic components, nec	DK	DK	1000	N
	Reaction/synthesis media processing	Cyclic crudes and intermediates,indust. organic chemicals,nec	35	65	2000	Cyanides(0.1-1%)
Caustic solution with metals and cyanides	Other poll. control or waste treatment process	Special warehousing and storage, nec	10(5*)	85	20000	N
	Stripping	Semiconductors and related devices	24	P	P	N
	Electroplating	Electron tubes, transmitting	P	99	44	N
	Electroplating	Current-carrying wiring dev.,semicon. and rel. dev., elect. comp. nec	1	98	1	N
	Electroplating	Farm machinery and equipment	1	98	100	N
	Dip rinsing	Noncurrent-carrying wiring devices	0	80	100	Cd(0.1-1%)
	Electroplating	Electronic computing equipment	P	95	1000	Cyanides(0.1-1%)
	Laboratory wastes	Steel pipe and tubes	DK	DK	3100	Cyanides(0.1-1%)
	Surface coating	Plating and polishing	38	62	6854	Zinc cyanide(1-10%), Cu(0.1-1%), Zn(25-50%)
	Electroplating	Speed changers, drives and gears,aircraft equip., nec	DK	90	8800	Copper cyanide(25-50%),Cu(0.1-1%)
	Electroplating	Nonferrous rolling and drawing, nec	NA	NA	DK	Cyanides(10-25%)
Concentrated off-spec or discarded product	Discarding of off-spec material	Misc. plastics products	DK	0	5	N
Lab packs of old chemicals only	Laboratory wastes	Colleges and universities, nec	83	0	5	N
Metal-cyanide salts/chemicals	Electroplating	Plating and polishing	99	1	1000	Copper cyanide(1-10%), Cu(1-10%)
	Other waste production process	Ship building and repairing	DK	DK	DK	N
	Discarding of off-spec material	National security, gen. automotive repair shops	2	93	P	N
	Discarding of out-of-date products or chemicals	Industrial controls	85	15	P	N
Other inorganic liquid	Surface coating	Semicond. and rel. devices, plating and polishing	0	99	1	N
	Dip rinsing	Electron tubes, transmitting,x-ray apparatus and tubes	2	98	1	N
	Electroplating	Electronic components, nec	DK	98	1	N
	Other poll. control or waste treatment process	Organic fibers, noncellulosic	(2*)	85	10	N
	Electroplating	Plating and polishing	NA	DK	55	N
	Other process	Primary aluminum	DK	98	580	N
	Pyrolysis	Blast furnaces and steel mills	1	99	720	N
	Wastewater treatment	Industrial inorganic chemicals, nec	5(0*)	95	50000	N
Other inorganic solids	Dewatering	Organic fibers, noncellulosic	98	1	20	Cu(300ppm-0.1%),Ni(25-50%)
	Accidental spills & discharges	Organic fibers, noncellulosic	99	NA	50	N
	Closure of process equipment	Semiconductors and related devices	98	NA	1000	Cyanides(1-10%)
Other organic liquid	Discarding of off-spec material	Soap and other detergents	5	50	1	N
Other organic sludge	Filtration/centrifuging	Organic fibers, noncellulosic	25	70	10	Ni(25-50%)
Other reactive salts/chemicals	Other process	Fabricated metal products, nec,aircraft engines and engine parts	95	4	0	N
	Other waste production process	DK	75	25	0	N
	Other waste production process	Indust. organic chemicals, nec,cyclic crudes and intermeds.,synth. rubber	75	25	0	N
	By-product processing	Primary nonferrous metals, nec	100	0	1.7	N
	Surface coating	Aircraft engines and engine parts	85	DK	DK	N
	Laboratory wastes	Junior colleges	DK	DK	DK	N
	Discarding of off-spec material	Industrial organic chemicals, nec	99	DK	DK	N
	Other process	Biological products	DK	DK	DK	N
	Molding/forming	Industrial inorganic chemicals, nec	99	0	DK	N
Other sludge with cyanides	Other poll. control or waste treatment process	Organic fibers, noncellulosic	30(10*)	53	10	Ni(0.1-1%)
	Filtering/screening	Organic fibers, noncellulosic	25(5*)	65	10	Ni(0.1-1%)
Other untreated waste	Electroplating	Small arms,plating and polishing	100	NA	3.5	N
Reactive cyanide salts/chemicals	Discarding of out-of-date products or chemicals	Research and development labs	99	DK	0	Sodium cyanide(10-25%),potassium cyanide(50-75%)
	Other waste production process	Aircraft	73	DK	0	N
	Clean out of process equipment	Motor vehicle parts and accessories	100	NA	24700	Benzene(500ppm-0.1%)
	Electroplating	Plating and polishing,metal coating and allied servs.,ordnance and access. nec	100	0	100000	Copper cyanide(10-25%), Cd(1-10%),Cu(1-10%)
	Cleanout of process equipment	Small arms ammunition	100	0	230000	N
	Discarding of out-of-date products or chemicals	Plating and polishing	70	30	700000	Cyanides(50-75%),Ag(50-75%)
	By-product processing	Semiconductors and related devices	NA	NA	DK	N
	Nitration	Metal heat treating	99	0	39903	Sodium cyanide(1-10%)
Reactive or polymerizable organics	Other poll. control or waste treatment proc.	Refuse systems	5	90	170	Toluene(1-10%)
Reactive organic solid	Laboratory wastes	Semiconductors and related devices	100	0	0	N
	Discarding of off-spec material	Semiconductors and related devices	85	15	0	N
	Dewatering	Organic fibers, noncellulosic	98	1	20	N

Table D-2 (continued)

SIC code	Waste description	Waste code	Industry description	Amount generated in tons	Management practice in 1986
2833	Medicinal chemicals and botanicals	D003	Caustic solution with cyanides but no metals	27,090	Surface impoundment
		P106	Caustic solution with cyanides but no metals		
2879	Alkalies and chlorine	D002	Acidic aqueous waste	179,036	Surface impoundment
		D003	Aqueous waste with other reactives (e.g., explosives)		
3482	Small arms ammunition explosives (TNT production, lead azide, etc.)	D002 D003 K044 K046	Aqueous waste with other reactives (e.g., explosives)	1,750	Surface impoundment

Reference: USEPA 1986a.

Table D-2 (continued)

SIC code	Waste description	Waste code	Industry description	Amount generated in tons	Management practice in 1986
2816	Inorganic pigments	D002	Soil contaminated with organics	20	Landfill
		D003			
9711	National security	D001	Nonhalogenated solvent	1	Landfill
		F003			
		F005			
1321	Oil and gas extraction	0001	Spent solid filters or absorbents	61	Landfill
		0003			
2821	Plastics materials, synthetic resins, and non-volcanizable elastomers	D001	Acidic aqueous waste	1,352	Surface impoundment
		D002	Other reactive sales/chemicals		
		D003			
2833	Medicinal chemicals and botanical products	D001	Concentrated solvent-water solution	2,458,353	Surface impoundment
		D002	Acidic aqueous waste		
		D002	Caustic aqueous waste		
		D003	Caustic solution with cyanides but no metals		
		F002	Aqueous waste with low solvents		
		F003	Aqueous waste with low solvents		
		P106	Caustic solution with cyanides but no metals		
		U080	Halogenated (e.g., chlorinated) solvent		
		U112	Nonhalogenated solvent		
		U154	Nonhalogenated solvent		
		U220	Nonhalogenated solvent		

Table D-2 (continued)

SIC code	Waste description	Waste code	Industry description	Amount generated in tons	Management practice in 1986
2869	Industrial organic chemicals, nec	D002 D003	Reactive or polymerizable organic liquid	182,385	Surface impoundment
		D001 D002 D003	Reactive or polymerizable organic liquid	65,753	Surface impoundment
		D001 D003	Reactive or polymerizable organic liquid	19	Surface impoundment
		D001 D002 D003 D007	Aqueous waste with low solvents Acidic aqueous waste Aqueous waste with reactive sulfides Other inorganic liquid	40,725	Surface impoundment
		D002 D003	Spent caustic Aqueous waste with reactive sulfides	75,000	Underground injection
		D002 D003	Acidic aqueous waste Aqueous waste with other reactives (e.g., explosives)	810,608	Underground injection
		D003 D004 D005 D007	Other waste inorganic chemicals	383	Landfill

Table D-2 **(continued)**

SIC code	Waste description	Waste code	Industry description	Amount generated in tons	Management practice in 1986
2911	Petroleum refining (cont.)	D002 D003	Aqueous waste with other reactives (e.g., explosives)	3,000	Surface impoundment
		D002 D003	Caustic aqueous waste Aqueous waste with reactive sulfides	668,685	Underground injection
2860	Colleges, universities, professional schools, and junior colleges	D001 D002 D003 U075 U151	Lab packs of old chemicals only	5	Landfill
2800	General chemical manufacturing	D001 D009 D003	Lab packs of debris only	1	Landfill
		D003 D006 D011	Lab packs of old chemicals only	1	Landfill
		D001 D002 D003 F003	Reactive or polymerizable organic liquid Nonhalogenated solvent	899	Surface impoundment
		D001 D002 D003	Nonhalogenated solvent Reactive or polymerizable organic liquid	37	Surface impoundment

Table D-2 **Characterization and Industry Data for Mixed Wastes Containing Reactive Wastes According to the 1986 TSDR Survey for Non-CBI Facilities Only**

SIC code	Industry description	Waste code	Waste description	Amount generated in tons	Management practice in 1986
2911	Petroleum refining	D001 D003 D007 D008	Oily sludge	11	Land treatment
		D001 D003	Oily sludge	538	Land treatment
		D001 D002 D003	Reactive sulfide salts/chemicals	7	Land treatment
		D002 D003	Metal scale, filings, or scrap	2	Land treatment
		D001 D002 D003	Concentrated aqueous solution of other organic	239	Surface impoundment
		D002 D003	Spent caustic	1,749	Surface impoundment
		D003 D002	Spent caustic	4,878	Surface impoundment

Table D-1 Characterization and Industry Data for D003 Wastes That Are Only Characteristic Reactive Wastes (i.e., not mixed with other hazardous wastes) According to the 1986 TSDR Survey for Non-CBI Facilities Only

SIC code	Industry description	Waste description	Amount generated in tons	Management practice in 1986
2911	Petroleum refining	Oily sludge	13,461	Land treatment
		Soil contaminated with inorganics	44	Land treatment
		Sludge with reactive sulfides	13	Land treatment
		Aqueous waste with reactive sulfides	45,150	Underground injection
		Aqueous waste with reactive sulfides	2,983,333	Underground injection
		Aqueous waste with reactive sulfides	1,216,667	Underground injection
		Aqueous waste with reactive sulfides	1,212,500	Underground injection
		Sludge with other reactives	77	Landfill
		Reactive sulfide salts/chemicals	3,701	Waste piles
2811	Other chemicals and allied industries	Reactive organic solid	1	Landfill
9511	Industrial organic chemicals, nec	Other waste inorganic chemicals	1	Landfill
2800	Industrial organic chemicals, nec	Nonhalogenated solvent	7	Surface impoundment
2800	Chemicals and chemical preparations, nec	Reactive sulfide salts/chemicals	1	Landfill
2822		Nonhalogenated solvent	825,312	Surface impoundment
2869	Industrial organic chemicals, nec	Reactive organic solid	36	Surface impoundment
		Reactive or polymerizable organic liquid	120,833	Underground injection
2892	Explosives (TNT production, lead azide, etc.)	Aqueous waste with other reactives (e.g., explosives)	4	Surface impoundment
3644	Electroplating, plating, polishing, anodizing, and coloring	Other inorganic liquid	4,610	Surface impoundment
9711	National security	Reactive sulfide salts/chemicals	1	Surface impoundment
9711	Research and development laboratories	Other reactive salts/chemicals	1	surface impoundment
3312	Blast furnaces (including coke ovens), steel works, and rolling mills	Caustic with solution cyanides but no metals	45,833	Underground injection
2892	Explosives	Other inorganic solids	1	Waste piles
		Aqueous waste with other reactives (e.g., explosives)	15	Surface impoundment
		Other reactive salts/chemicals	52	Surface impoundment
3321	Gray iron foundries	Other "dry" ash, slag, or thermal residue	7,271	Waste piles
		Other "dry" ash, slag, or thermal residue	2,827	Waste piles
		Other "dry" ash, slag, or thermal residue	2,320	Waste piles

Reference: USEPA 1986a.

APPENDIX D

WASTE CHARACTERIZATION AND INDUSTRIAL DESCRIPTIONS FOR D003 WASTES

Table C-2 Corrosive Waste Quantity Handled by Industrial Classification (million gallons/year)

SIC code	Industry description	Waste quantity handled[a]		
		High	Low	Percent
28	Chemicals and allied products	18,3373	15,590	71.5
49	Electric, gas, and sanitary services	2,305	1,960	9.0
29	Petroleum refining	1,150	978	4.5
33	Primary metals	1,143	972	4.5
26	Paper and allied products	1,126	957	4.4
36	Electric and electronic machinery, equipment, and supplies	581	495	2.3
35	Machinery, except electrical	417	354	1.6
32	Stone, clay, glass, concrete	190	162	0.7
34	Fabricated metals	183	156	0.7
37	Transportation equipment	136	115	0.5
20	Food and kindred products	27	23	0.1
--	Other industries	50	42	0.2
	Total:	25,645	21,803	100.0

[a] Includes D002 and K062 only.

Source: USEPA. 1988c.

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Organic sludges	Oily sludge	Petroleum refining	3 T	DK	10	present	8
	Oily sludge	Space research and technology	8 T	60	40	DK	11
Organic sludges	Organic paint or ink sludge	Cyclic crudes and intermediates	3 T	65	30	20	2
Organic sludges	Other organic sludge	General chemical manufacturing	21 T	48	52	1	3
	Other organic sludge	Industrial organic chemicals, nec	8 T	80	20	80	2
	Other organic sludge	Industrial organic chemicals, nec	1 T	80	5	95	2
	Other organic sludge	Plastics materials and resins	10985 G	2	48	DK	10
	Other organic sludge	Plating and polishing	200 G	90	2	DK	8
Organic sludges	Reactive or polymerizable organics	Toilet preparations	312 G	28	5	1	2
Organic sludges	Resins, tars or tarry sludge	Petroleum refining	14 T	65	DK	DK	6
Organic sludges	Still bottoms of nonhalogenated organic liquids	Industrial organic chemicals, nec	64 T	60	30	64	2
	Still bottoms of nonhalogenated organic liquids	Petroleum refining	14700 G	8	88	0.4	8
Organic solids	Nonhalogenated pesticide solid	Agricultural chemicals, nec	10 T	99	0	15	10
Organic solids	Other halogenated organic solid	Chemical preparations, nec	100 T	DK	DK	DK	2
	Other halogenated organic solid	Industrial organic chemicals, nec	184 T	100	5	N/A	2
	Other halogenated organic solid	Synthetic rubber, Industrial organic chemicals, nec	163 T	50	50	7	10
Organic solids	Other nonhalogenated organic solid	Aircraft	8814 G	99	DK	DK	2
	Other nonhalogenated organic solid	Ammunition, except for small arms, nec	96 G	99	0	0	4
	Other nonhalogenated organic solid	Chemicals and allied products	1010 G	80	0	DK	12
	Other nonhalogenated organic solid	General chemical manufacturing,Surface active agents	9 T	80	15	present	10
	Other nonhalogenated organic solid	Industrial organic chemicals, nec	4 T	60	1	present	2
	Other nonhalogenated organic solid	Industrial organic chemicals, nec	123 T	92	8	31	2.7
	Other nonhalogenated organic solid	Motor vehicles and car bodies	55 G	37	N/A	DK	2
	Other nonhalogenated organic solid	Sausages and other prepared meats	284 T	6	94	present	2
	Other nonhalogenated organic solid	Valves and pipe fittings	550 G	94	6	0	7
Organic solids	Reactive organic solid	DK	8 T	53	0	DK	2
	Reactive organic solid	Industrial inorganic chemicals, nec	0 T	91	9	86	10
Organic solids	Solid resins or polymerized organics	Cyclic crudes and intermediates	8 T	99	1	6	7
	Solid resins or polymerized organics	Industrial organic chemicals, nec	3685 G	85	N/A	N/A	12
Organic solids	Spent carbon	Cyclic crudes and intermediates,Industrial organic chemicals, nec	2 T	50	50	present	2
	Spent carbon	Cyclic crudes and intermediates,Industrial organic chemicals, nec	17 T	50	50	present	2
	Spent carbon	Industrial organic chemicals, nec	15 T	66	0	DK	2
Organic solids	Spent carbon	Organic pesticide products	880 G	90	10	N/A	2.7
	Spent carbon	Pharmaceutical preparations	4 T	90	10	DK	2

DK=Don't know
G=Gallons
T=Tons
N/A=Not available

Reference: USEPA 1988e

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Lab packs (continued)	Mixed lab packs	Electronic computing equipment, Semiconductors and related devices	1048 G	99	N/A	N/A	2
Organic liquids	Concentrated aqueous solution of other organics	Chemicals and allied products	1790 G	5	10	DK	12
	Concentrated aqueous solution of other organics	General chemical manufacturing	2296 G	0	present	present	2
	Concentrated aqueous solution of other organics	General chemical manufacturing	38 T	15	85	DK	2
	Concentrated aqueous solution of other organics	General chemical manufacturing	182 T	2	95	2	2
	Concentrated aqueous solution of other organics	Industrial organic chemicals, nec	3000 G	DK	50	DK	2
	Concentrated aqueous solution of other organics	Instruments to measure electricity	1 T	5	15	DK	2
	Concentrated aqueous solution of other organics	Medicinals and botanicals	6910 T	45	55	DK	2.3
	Concentrated aqueous solution of other organics	National security	1 T	0	60	DK	2
	Concentrated aqueous solution of other organics	Pharmaceutical preparations	96 T	DK	DK	DK	2
	Concentrated aqueous solution of other organics	Semiconductors and related devices	2265 G	0	DK	DK	2
	Concentrated aqueous solution of other organics	Semiconductors and related devices	935 G	0	DK	DK	3
	Concentrated aqueous solution of other organics	Semiconductors and related devices	2478 G	0	DK	DK	11
	Concentrated aqueous solution of other organics	Telephone and telegraph apparatus, Semiconductors and related devices,Radio and TV communication eq	65 G	2	66	DK	12
Organic liquids	Concentrated phenolics	Industrial organic chemicals, nec	81996 G	N/A	0	DK	11
	Concentrated phenolics	Petroleum refining	519022 G	2	98	DK	8
Organic liquids	Concentrated solvent-water solution	Photographic equipment and supplies	20000 G	13	79	10	2
Organic liquids	Halogenated (e.g., chlorinated)solvent	Truck and bus bodies	2 T	1	DK	DK	6
Organic liquids	Halogenated/nonhalogenated solvent mixture	Coating, engraving, and allied services, Refrigeration and heating equipment	110 G	7	DK	DK	3
	Halogenated/nonhalogenated solvent mixture	Electronic resistors	3 T	DK	1	DK	2
	Halogenated/nonhalogenated solvent mixture	Engineering and scientific instruments, Surgical and medical instruments	591 G	DK	DK	DK	2
	Halogenated/nonhalogenated solvent mixture	Space propulsion units and parts	110 G	1	10	95	3
Organic liquids	Nonhalogenated solvent	Cyclic crudes and intermediates	2 T	10	25	60	12
Organic liquids	Oil-water emulsion or mixture	Petroleum refining	1483 T	DK	25	DK	2
Organic liquids	Organic paint, ink, lacquer, or varnish	Pens and mechanical pencils	787 G	0	95	present	3
	Organic paint, ink, lacquer, or varnish	Pens and mechanical pencils	317 G	50	45	present	3
Organic liquids	Other organic liquid	Agricultural chemicals, nec	3 T	present	present	present	2
	Other organic liquid	Chemical preparations, nec	25900 G	5	95	5	3
	Other organic liquid	DK	0	0	20	DK	12
	Other organic liquid	Electronic components, nec	1152 G	20	75	DK	2
	Other organic liquid	Electronic components, nec	4342 G	0	70	N/A	2
	Other organic liquid	General chemical manufacturing, Industrial organic chemicals, nec	43127 T	DK	DK	DK	2
	Other organic liquid	Industrial organic chemicals, nec	10045537 T	1	99	1	8
	Other organic liquid	Metal coating and allied services	65366 G	4	95	DK	3.4
	Other organic liquid	Metal coating and allied services	118 T	99	DK	DK	11
	Other organic liquid	Organic fibers, noncellulosic	DK	DK	DK	DK	2
	Other organic liquid	Organic fibers, noncellulosic, Plastics materials and resins	2 T	N/A	5	DK	2
	Other organic liquid	Paper mills, except building paper	390 G	10	90	DK	2
	Other organic liquid	Petroleum refining	190 T	N/A	1	DK	2
	Other organic liquid	Plastics materials and resins	485 T	0	5	1	2
	Other organic liquid	Plastics materials and resins	1 T	5	90	DK	10
	Other organic liquid	Plastics materials and resins, Industrial organic chemicals, nec	1815	DK	1	N/A	5
	Other organic liquid	Semiconductors and related devices	2800 G	1.5	5	DK	12
Organic liquids	Paint thinner or petroleum distillates	Cathode ray television picture tubes	46 G	10	DK	DK	4
Organic liquids	Spent solvent	Metal coating and allied services	9000 G	N/A	99	N/A	6.5
	Spent solvent	Paper coating and glazing	6 T	4	58	30	12
Organic liquids	waste oil	Ordinance and accessories, nec, Screw machine products	4070 G	present	70	present	2
Organic sludges	Adhesives or epoxies	DK	1 T	DK	DK	DK	7

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic solids (continued)	Other inorganic solids	Semiconductors and related devices	144 G	100	0	0	2
	Other inorganic solids	Semiconductors and related devices	24 T	99	0	0	2
	Other inorganic solids	Semiconductors and related devices	100 T	98	2	0	2
	Other inorganic solids	Semiconductors and related devices	1 T	N/A	60	N/A	3
	Other inorganic solids	Space research and technology	1 T	99	DK	DK	12
	Other inorganic solids	Tanks and tank components	2 T	98	2	DK	12
Inorganic solids	Other reactive salts/chemicals	Aluminum extruded products	25 T	85	15	0	12
	Other reactive salts/chemicals	Chemicals and allied products	1220 G	present	DK	DK	2
	Other reactive salts/chemicals	Construction machinery	1640 G	98	2	DK	4
	Other reactive salts/chemicals	Hardware, nec, Plating and polishing	770 G	95	5	DK	3
	Other reactive salts/chemicals	Industrial organic chemicals, nec	1 T	25	23	5	6
	Other reactive salts/chemicals	Iron and steel forgings, Metal coating and allied services	16875 G	95	5	DK	2
	Other reactive salts/chemicals	National security	14 T	100	0	DK	9
	Other reactive salts/chemicals	Plating and polishing	DK	60	40	N/A	2
	Other reactive salts/chemicals	Small arms, Plating and polishing	0	DK	95	DK	12
Inorganic solids	Other waste inorganic chemicals	Electronic components, nec	3 T	90	10	N/A	2
	Other waste inorganic chemicals	Electronic components, nec	5 G	DK	DK	DK	12.5
	Other waste inorganic chemicals	Electronic computing equipment	7 G	N/A	present	present	2
	Other waste inorganic chemicals	Electronic computing equipment	36 G	0	56	DK	2
	Other waste inorganic chemicals	Industrial inorganic chemicals, nec	102 T	99	1	N/A	2
	Other waste inorganic chemicals	Industrial inorganic chemicals, nec, Chemical preparations, nec	25 T	99	1	DK	12
	Other waste inorganic chemicals	Motor vehicles and car bodies	115 T	99	1	0	11
	Other waste inorganic chemicals	Petroleum refining	179 T	100	DK	DK	2.3
	Other waste inorganic chemicals	Screw machine products	6	DK	DK	DK	11
Inorganic solids	Solidified treatment residue	Commercial printing, letterpress,Food products machinery	150 G	0	40	0	3
Inorganic solids	Spent solid filters or adsorbents	Electric services	1 T	99	DK	DK	4
	Spent solid filters or adsorbents	Industrial organic chemicals, nec	9 T	70	20	8	2
	Spent solid filters or adsorbents	Industrial organic chemicals, nec	1 T	95	1	DK	2
	Spent solid filters or adsorbents	Industrial organic chemicals, nec	10 T	90	10	present	6
	Spent solid filters or adsorbents	Miscellaneous plastics products, Plating and polishing	258 G	20	80	DK	5
	Spent solid filters or adsorbents	Nonclassifiable establishment	129 T	75	25	1	2
	Spent solid filters or adsorbents	Organic fibers, noncellulosic	36 T	42	50	present	12
	Spent solid filters or adsorbents	Plating and polishing	16 T	48	DK	DK	7
	Spent solid filters or adsorbents	Services, nec	8336 G	95	2	DK	9
	Spent solid filters or adsorbents	Soap and other detergents	6 T	75	25	20	2
Lab packs	Concentrated off-spec or discarded product	Agricultural chemicals, nec	2 T	DK	5	DK	12
	Concentrated off-spec or discarded product	Chemicals and allied products	55 G	0	90	DK	2
	Concentrated off-spec or discarded product	Chemicals and allied products, Petroleum products, nec	2 T	99	1	N/A	2
	Concentrated off-spec or discarded product	Industrial controls	55 G	DK	70	N/A	2
	Concentrated off-spec or discarded product	Motor vehicles and car bodies	245 G	99	present	DK	12
	Concentrated off-spec or discarded product	National security	63 T	0	present	present	12
	Concentrated off-spec or discarded product	Plumbing, heating, air conditioning	53 G	25	50	DK	11
	Concentrated off-spec or discarded product	Semiconductors and related devices	275 G	0	65	0	2
	Concentrated off-spec or discarded product	Surface active agents	1 T	51	N/A	present	2
Lab packs	Empty or crushed metal drums or containers	Radio and TV communication equipment	168 T	99	N/A	N/A	2
Lab packs	Lab packs of old chemicals only	Electronic computing equipment,Electronic components, nec	1 T	95	DK	N/A	2
	Lab packs of old chemicals only	Industrial controls	1 T	DK	80	N/A	2
	Lab packs of old chemicals only	Medicinals and botanicals, Pharmaceutical preparations	2 T	0	90	13	6.5
	Lab packs of old chemicals only	Pens and mechanical pencils, Plating and polishing	120 G	99	0	DK	2
	Lab packs of old chemicals only	Pens and mechanical pencils, Plating and polishing	30 G	99	0	present	2
	Lab packs of old chemicals only	Radio and TV communication equipment	486 G	DK	DK	DK	2
	Lab packs of old chemicals only	Research and development laboratories	6 T	DK	DK	DK	3
	Lab packs of old chemicals only	Storage batteries	1 T	0	1	DK	2
Lab packs	Mixed lab packs	Cyclic crudes and intermediates	1 T	90	DK	10	2

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic sludges	Untreated plating sludge with cyanides	Alkalies and chlorine	1 T	20	80	0	2
Inorganic sludges	Untreated plating sludge without cyanides	Coating, engraving, and allied services, Metal coating and allied services, Screw machine products	6300 G	DK	DK	N/A	2
	Untreated plating sludge without cyanides	Instruments to measure electricity	2 T	DK	N/A	N/A	11
	Untreated plating sludge without cyanides	Motor vehicle parts and accessories, Automotive stampings, Automotive parts and supplies	3 T	73	27	DK	2
	Untreated plating sludge without cyanides	Plating and polishing	2T	70	20	70	2
	Untreated plating sludge without cyanides	Plating and polishing	50 G	95	present	present	2
	Untreated plating sludge without cyanides	Plating and polishing,Metal coating and allied services	1 T	60	40	DK	7
	Untreated plating sludge without cyanides	Tanks and tank components	6 T	98	2	DK	2
Inorganic sludges	Wastewater treatment sludge with toxic organics	Cyclic crudes and intermediates	1072 T	75	20	2	10
	Wastewater treatment sludge with toxic organics	Plating and polishing	576 G	20	present	DK	3
Inorganic solids	Ash, slag, or other residue from incineration	Refuse systems	36 T	99	0	0	12
Inorganic solids	Batteries or battery parts, casings, cores	DK	29 T	90	79	N/A	2
	Batteries or battery parts, casings, cores	Petroleum refining	3 T	present	present	N/A	2
	Batteries or battery parts, casings, cores	Railroads, line-haul operating,Switching and terminal devices	855 G	N/A	30	N/A	12
	Batteries or battery parts, casings, cores	Semiconductors and related devices, Electron tubes, receiving type, Electronic connectors	1 T	99	1	DK	2
Inorganic solids	Dry lime or metal hydroxide solids chemically "fixed"	Motor vehicles and car bodies	1050 G	98	0	present	10
	Dry lime or metal hydroxide solids chemically "fixed"	Transformers, Plating and polishing	1 T	100	0	0	12
	Dry lime or metal hydroxide solids chemically "fixed"	Vehicular lighting equipment	79 T	N/A	N/A	N/A	12
Inorganic solids	Dry lime or metal hydroxide solids not "fixed"	Ball and roller bearings	DK	DK	DK	DK	8
	Dry lime or metal hydroxide solids not "fixed"	National security	10 G	DK	DK	DK	12
Inorganic solids	Other "dry" ash, slag, or thermal residue	Alkalies and chlorine	48 G	99	1	DK	2
Inorganic solids	Other inorganic solids	Agricultural chemicals, nec	713 G	99	1	present	12
	Other inorganic solids	Aircraft	8 T	DK	DK	DK	2
	Other inorganic solids	Aircraft engines and engine parts	5600 G	99	1	DK	12
	Other inorganic solids	Aluminum sheet, plate, and foil, Aluminum rolling and drawing, nec	1 T	90	N/A	N/A	2
	Other inorganic solids	Chemical preparations, nec	440 G	60	40	N/A	12
	Other inorganic solids	DK	100122 G	100	N/A	N/A	8.5
	Other inorganic solids	Electronic components, nec	4 T	40	60	N/A	2
	Other inorganic solids	Electronic components, nec, Plating and polishing	18 T	99	present	present	8
	Other inorganic solids	Electronic computing equipment, Semiconductors and related devices	0	99	present	present	2
	Other inorganic solids	Electronic computing equipment, Semiconductors and related devices	0	98	N/A	N/A	12
	Other inorganic solids	Electronic computing equipment,Electronic components, nec	1 T	98	0	0	2
	Other inorganic solids	Electronic computing equipment,Electronic components, nec	1 T	98	0	N/A	2
	Other inorganic solids	Guided missiles and space vehicles, Space propulsion units and parts	1 T	99	1	N/A	3
	Other inorganic solids	Hardware, nec, Plating and polishing	55 G	90	10	DK	3
	Other inorganic solids	Hardware, nec, Plating and polishing	605 G	90	10	DK	12
	Other inorganic solids	Industrial gases	1 T	99	1	0	12
	Other inorganic solids	Industrial inorganic chemicals, nec	1 T	N/A	5	present	2
	Other inorganic solids	Industrial inorganic chemicals, nec	60 T	99	DK	DK	2
	Other inorganic solids	Industrial organic chemicals, nec	28 T	10	20	N/A	2
	Other inorganic solids	Industrial organic chemicals, nec	24 T	90	10	present	2
	Other inorganic solids	Instruments to measure electricity	1 T	30	present	DK	12
	Other inorganic solids	Metal coating and allied services	25 T	20	80	N/A	3.8
	Other inorganic solids	Motor vehicles and car bodies, Motor vehicle parts and accessories, Internal combustion engines, nec	3 T	92	N/A	DK	11
	Other inorganic solids	Noncurrent-carrying wiring devices	10 T	99	1	DK	12
	Other inorganic solids	Ordinance and accessories, nec	264 G	80	DK	N/A	6
	Other inorganic solids	Petroleum refining	108 T	100	0	DK	2
	Other inorganic solids	Petroleum refining	439 T	DK	DK	DK	2
	Other inorganic solids	Petroleum refining	98 T	84	16	6	3
	Other inorganic solids	Petroleum refining, Industrial inorganic chemicals, nec	2 T	92	8	DK	9
	Other inorganic solids	Plastics materials and resins, Industrial organic chemicals, nec	2 T	DK	DK	N/A	2
	Other inorganic solids	Pumps and pumping equipment	912 G	99	1	0	2
	Other inorganic solids	Screw machine products	990 G	91	9	DK	12
	Other inorganic solids		110 G	DK	DK	DK	11

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic liquids (continued)	Spent caustic	Electronic components, nec	86 G	DK	DK	DK	12
	Spent caustic	Electronic computing equipment	0	present	present	present	10
	Spent caustic	Gaskets, packing, and sealing devices, Fabricated rubber products, nec	530 G	present	DK	DK	10
	Spent caustic	Industrial gases	8 T	10	80	0	10
	Spent caustic	Internal combustion engines, nec	1900 G	18	90	present	12
	Spent caustic	Metal coating and allied services	2386 G	DK	DK	DK	12
	Spent caustic	Metal coating and allied services, Bolts, nuts, rivets, and washers	31500 G	3	91	DK	12
	Spent caustic	Metal coating and allied services, Coating, engraving, and allied services	DK	DK	97	DK	11
	Spent caustic	Metal coating and allied services, Iron and steel forgings	27250 G	DK	DK	DK	12
	Spent caustic	Metal coating and allied services,Special industry machinery, nec	100 G	DK	DK	DK	12
	Spent caustic	Miscellaneous metal work	2 T	DK	99	DK	12
	Spent caustic	Miscellaneous metal work, Aircraft	910 T	15	85	N/A	12
	Spent caustic	Miscellaneous metal work, Aircraft	409 T	12	88	N/A	12
	Spent caustic	Motor vehicle parts and accessories	5200 G	0	80	0	12
	Spent caustic	Motors and generators	60 G	18	5	DK	12
	Spent caustic	National security	232 G	DK	DK	60	2
	Spent caustic	National security	42 T	17	80	0	10
	Spent caustic	National security, Plating and polishing,Metal coating and allied services	375 G	1	80	N/A	12
	Spent caustic	National security,Blueprinting and photocopying	28 G	DK	DK	DK	2
	Spent caustic	Organic fibers, noncellulosic, Plastics materials and resins	29 T	DK	DK	N/A	12
	Spent caustic	Petroleum refining	418 T	1	99	0	7
	Spent caustic	Petroleum refining	805840 G	2	98	DK	10
	Spent caustic	Petroleum refining	30753840 G	DK	DK	DK	12
	Spent caustic	Petroleum refining	30000 G	1	99	N/A	12
	Spent caustic	Petroleum refining	21888 T	N/A	85	N/A	12.6
	Spent caustic	Plastics materials and resins	365 T	5	80	5	12
	Spent caustic	Plating and polishing	28 T	DK	99	DK	10
	Spent caustic	Plating and polishing,Metal coating and allied services, Electronic components, nec	3840 G	2	50	0	10
	Spent caustic	Radio and TV communication equipment	495 G	DK	70	N/A	12
	Spent caustic	Refuse systems	330 G	N/A	60	N/A	11
	Spent caustic	Screw machine products	4000 G	DK	DK	DK	11
	Spent caustic	Secondary nonferrous metals	960 G	1	65	DK	10
	Spent caustic	Ship building and repairing	1 T	DK	DK	DK	12
	Spent caustic	Ship building and repairing	1 T	DK	DK	DK	12
	Spent caustic	Steel investment foundries	10000 G	1	94	N/A	7
	Spent caustic	Steel investment foundries	10000 G	1	94	N/A	7
	Spent caustic	Steel wire and related products,Plating and polishing	20 T	80	20	0	12
	Spent caustic	Synthetic rubber	15 G	DK	50	DK	2
	Spent caustic	Valves and pipe fittings	1000 G	12	80	0	12
Inorganic sludges	Air pollution control device sludge	Coating, engraving, and allied services	800 G	20	80	1	10
	Air pollution control device sludge	Industrial inorganic chemicals, nec	6190 T	N/A	70	N/A	4
Inorganic sludges	Chloride or other brine sludge	Fabricated metal products, nec	1045 G	10	90	DK	2
	Chloride or other brine sludge	Noncommercial research organizations	2 T	4	95	N/A	5.8
Inorganic sludges	Degreasing sludge with metal scale or filings	DK	24 T	90	8	3	12
Inorganic sludges	Lime sludge with metals/metal hydroxide sludge	Copper rolling and drawing	591 T	5	95	0	8
	Lime sludge with metals/metal hydroxide sludge	DK	2304 G	50	50	present	12
	Lime sludge with metals/metal hydroxide sludge	Metal coating and allied services	50 G	20	80	0	8
	Lime sludge with metals/metal hydroxide sludge	Metal coating and allied services	700 G	28	72	0	8
Inorganic sludges	Lime sludge without metals	Petroleum refining	1085 T	18	present	present	12
Inorganic sludges	Other wastewater treatment sludge	Cyclic crudes and intermediates	1 T	40	60	N/A	2
	Other wastewater treatment sludge	Manufacturing industries, nec	125 T	90	10	N/A	7
	Other wastewater treatment sludge	Paints and allied products,Plastics materials and resins	10 T	70	30	N/A	10
	Other wastewater treatment sludge	Refuse systems, Trucking, except local, Research and development laboratories	11 T	50	50	present	10
	Other wastewater treatment sludge	Services, nec	45571 G	75	25	DK	10
	Other wastewater treatment sludge	Trucking, except local	9500 G	38	50	8	12

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic liquids (continued)	Spent acid without metals	Explosives, Industrial inorganic chemicals, nec	354400 T	1	99	0	2
	Spent acid without metals	Fabricated metal products, nec	DK	DK	DK	DK	2
	Spent acid without metals	Fabricated metal products, nec	110 G	DK	90	DK	2
	Spent acid without metals	General automotive repair shops	168 G	N/A	98	N/A	7
	Spent acid without metals	General chemical manufacturing	1387 T	10	30	0	2
	Spent acid without metals	Guided missiles and space vehicles	150 G	90	DK	N/A	3
	Spent acid without metals	Industrial controls	4720 G	DK	70	N/A	2
	Spent acid without metals	Industrial inorganic chemicals, nec	20423 T	0	98	0	2
	Spent acid without metals	Industrial organic chemicals, nec	20 T	0	30	45	2
	Spent acid without metals	Industrial organic chemicals, nec	40000 G	8	95	6	2
	Spent acid without metals	Industrial organic chemicals, nec	110 G	DK	10	0	2
	Spent acid without metals	Industrial organic chemicals, nec, Industrial inorganic chemicals, nec,General chemical manufacturing	296244 T	DK	65	1	2
	Spent acid without metals	Metal coating and allied services	8000 G	1	99	N/A	2
	Spent acid without metals	Metal coating and allied services	22 T	1	98	0	6
	Spent acid without metals	Metal coating and allied services, Metal heat treating, Primary metal products, nec	249024 G	12	88	1	2
	Spent acid without metals	Metal coating and allied services, Metal heat treating, Primary metal products, nec	671760 G	12	88	1	2
	Spent acid without metals	Metal stampings, nec	13500 G	100	0	0	2
	Spent acid without metals	Miscellaneous metal work	20000 G	5	90	DK	12
	Spent acid without metals	Motor vehicle parts and accessories	7800 G	0	50	0	2
	Spent acid without metals	Motor vehicles and car bodies	800 G	0	98	0	2
	Spent acid without metals	National security	144 G	DK	DK	DK	2
	Spent acid without metals	National security	0	DK	DK	DK	2
	Spent acid without metals	National security	0	DK	DK	DK	2
	Spent acid without metals	National security	2 T	DK	DK	DK	2
	Spent acid without metals	National security, Aircraft	150 G	present	present	N/A	2
	Spent acid without metals	Noncommercial research organizations	3 T	15	75	N/A	3.5
	Spent acid without metals	Organic fibers, noncellulosic	13517 T	4	97	0	2
	Spent acid without metals	Organic fibers, noncellulosic, Plastics materials and resins	1 T	0	40	N/A	2
	Spent acid without metals	Petroleum refining	62315 T	1	95	DK	2
	Spent acid without metals	Petroleum refining	170 T	DK	present	present	10
	Spent acid without metals	Pharmaceutical preparations	2 T	N/A	5	N/A	2
	Spent acid without metals	Plastics materials and resins, Industrial organic chemicals, nec	304553 T	2	98	present	7
	Spent acid without metals	Plating and polishing	74 G	3	97	present	2
	Spent acid without metals	Plating and polishing	600 G	0	65	0	2
	Spent acid without metals	Plating and polishing	500 G	0	30	0	2
	Spent acid without metals	Products of purchased glass	3 T	0	80	0	2
	Spent acid without metals	Pulp mills	1200 G	DK	DK	DK	2
	Spent acid without metals	Repair services, nec	93 T	0	99	0	2
	Spent acid without metals	Research and development laboratories	58 G	25	DK	75	2
	Spent acid without metals	Secondary nonferrous metals, Aluminum rolling and drawing, nec, Nonferrous rolling and drawing, nec	17280 G	DK	1	DK	7
	Spent acid without metals	Semiconductors and related devices	34136 G	present	90	N/A	8
	Spent acid without metals	Semiconductors and related devices	804685 T	1	99	1	7
	Spent acid without metals	Semiconductors and related devices	272394 G	DK	95	0	7
	Spent acid without metals	Semiconductors and related devices	6000000 G	DK	present	DK	8
	Spent acid without metals	Ship building and repairing	2 T	DK	DK	DK	2
	Spent acid without metals	Ship building and repairing	2 T	DK	DK	DK	2
	Spent acid without metals	Space research and technology	5 G	10	50	DK	3
	Spent acid without metals	Steel investment foundries	120 G	present	80	N/A	2
	Spent acid without metals	Surface active agents, Industrial organic chemicals, nec, Chemical preparations, nec	83 T	DK	DK	DK	2
Inorganic liquids	Spent caustic	Aircraft engines and engine parts	5400 G	DK	DK	DK	12
	Spent caustic	Aircraft engines and engine parts	2568 G	DK	DK	DK	12
	Spent caustic	Aircraft engines and engine parts	300 G	DK	DK	DK	12
	Spent caustic	Blast furnaces and steel mills	66 T	30	70	DK	12
	Spent caustic	Certified air transportation	5 T	8	DK	DK	12
	Spent caustic	Colleges and universities, nec	50 G	DK	present	0	12
	Spent caustic	Colleges and universities,nec, Medical laboratories	142 G	DK	DK	DK	9
	Spent caustic	Current-carrying wiring devices,Electronic components, nec, Electronic parts and equipment	654 G	DK	DK	0	9
	Spent caustic	DK	577749 G	5	90	DK	12
	Spent caustic	DK	49839 T	10	88	0	12
	Spent caustic	Electric services	2454105 G	DK	DK	DK	7
	Spent caustic	Electrical apparatus and equipment, Electronic parts and equipment	4000 G	DK	90	DK	12

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic liquids (continued)	Spent acid with metals	Plating and polishing	110 G	94	6	DK	6
	Spent acid with metals	Plating and polishing, Silverware and plated ware,Metal coating and allied services	2200 G	10	30	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services	9819000 G	0	95	0	3
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	16626 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	1160 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	1700 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	3160 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	2200 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	4000 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	780 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	960 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	80 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	1800 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	480 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	360 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	700 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	1000 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	80 G	1	99	0	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	678 T	0.6	DK	DK	2
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	10950 G	1	99	0	3
	Spent acid with metals	Plating and polishing,Metal coating and allied services, Electronic components, nec	5000 G	8	70	DK	8
	Spent acid with metals	Plating and polishing,Metal household furniture, Metal office furniture	170400 G	7	93	N/A	3
	Spent acid with metals	Primary metal products, nec	35000 G	2	98	N/A	2
	Spent acid with metals	Process control instruments	330 G	DK	DK	DK	2
	Spent acid with metals	Radio and TV communication equipment	15 T	10	95	1	2
	Spent acid with metals	Radio and TV communication equipment	10 T	DK	DK	DK	2
	Spent acid with metals	Research and development laboratories	165 G	present	present	DK	2
	Spent acid with metals	Research and development laboratories	495 G	19	DK	DK	2
	Spent acid with metals	Screw machine products	5 G	2	96	DK	8
	Spent acid with metals	Secondary nonferrous metals	14800 G	1	90	DK	3
	Spent acid with metals	Semiconductors and related devices	2000 G	0	99	0	2
	Spent acid with metals	Services, nec	12415 G	10	90	N/A	2
	Spent acid with metals	Services, nec	22000 G	2	99	N/A	2
	Spent acid with metals	Ship building and repairing	2112 G	DK	99	DK	2.2
	Spent acid with metals	Ship building and repairing	3466 G	DK	98	DK	2.7
	Spent acid with metals	Ship building and repairing	3950 G	DK	98	DK	11
	Spent acid with metals	Space research and technology	5 G	5	0	DK	4
	Spent acid with metals	Special warehousing and storage, nec	165 G	1	0	0	2
	Spent acid with metals	Speed changers, drives, and gears, Aircraft equipment	8289 G	DK	60	DK	2
	Spent acid with metals	Steel pipe and tubes	35 T	N/A	99	DK	2
	Spent acid with metals	Steel wire and related products	800000 G	1	99	1	2
	Spent acid with metals	Surgical and medical instruments	25 T	DK	95	N/A	7
	Spent acid with metals	Telephone and telegraph apparatus,Semiconductors and related devices	3800 G	1	33	0	2
	Spent acid with metals	Telephone and telegraph apparatus,Semiconductors and related devices	20000 G	1	94	DK	8
	Spent acid with metals	Telephone communication	3912 G	2	98	DK	3
	Spent acid with metals	Valves and pipe fittings	660 G	DK	70	DK	2
	Spent acid with metals	Valves and pipe fittings	DK	0	71	0	2
	Spent acid with metals	Valves and pipe fittings	6 T	present	98	present	2
Inorganic liquids	Spent acid without metals	Aircraft	36 T	0.1	DK	N/A	2
	Spent acid without metals	Aircraft engines and engine parts	624 G	DK	DK	DK	2
	Spent acid without metals	Aircraft equipment, nec	6500 G	18	DK	DK	3
	Spent acid without metals	Cellulosic man-made fibers	125 T	80	15	1	3
	Spent acid without metals	Cellulosic man-made fibers	119 T	75	15	1	4
	Spent acid without metals	Cyclic crudes and intermediates	2409140 G	DK	95	0	2
	Spent acid without metals	Cyclic crudes and intermediates, Photographic equipment and supplies	0	25	0	20	7
	Spent acid without metals	DK	3200 G	DK	60	DK	7.25
	Spent acid without metals	Electric services	0	DK	DK	DK	4
	Spent acid without metals	Electric services	200000 G	1	99	1	7
	Spent acid without metals	Electronic components, nec	5 G	DK	DK	DK	2
	Spent acid without metals	Electronic components, nec	30 G	DK	DK	DK	2
	Spent acid without metals	Electronic components, nec	10 G	DK	DK	DK	6.4

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic liquids (continued)	Spent acid with metals	Electronic components, nec	770 G	10	90	0	3
	Spent acid with metals	Electronic components, nec	220 G	DK	90	N/A	3
	Spent acid with metals	Electronic components, nec	98 G	N/A	50	present	3
	Spent acid with metals	Electronic components, nec	900 G	1	95	0	3
	Spent acid with metals	Electronic components, nec	2400 G	0	97	0	7
	Spent acid with metals	Electronic components, nec	13 T	DK	DK	DK	11
	Spent acid with metals	Electronic components, nec, Semiconductors and related devices	DK	1	97	1	2
	Spent acid with metals	Electronic computing equipment	13522500 G	present	90	present	2
	Spent acid with metals	Electronic computing equipment	1 T	5	95	N/A	2
	Spent acid with metals	Electronic computing equipment	4 T	10	90	present	2
	Spent acid with metals	Electronic computing equipment	14 T	30	95	0	2
	Spent acid with metals	Electronic computing equipment	9 T	10	95	DK	2
	Spent acid with metals	Electronic computing equipment	6 T	30	85	0	2
	Spent acid with metals	Electronic computing equipment	1 T	20	88	0	2
	Spent acid with metals	Electronic computing equipment	4 T	20	90	DK	2
	Spent acid with metals	Engine electrical equipment	140 G	0	present	0	3
	Spent acid with metals	Engraving and plate printing	800 G	present	90	N/A	2
	Spent acid with metals	Fabricated metal products, nec	18342 G	DK	DK	DK	2
	Spent acid with metals	Fabricated metal products, nec, Plating and polishing	1200 G	DK	80	N/A	2
	Spent acid with metals	Fabricated metal products, nec, Plating and polishing	1500 G	DK	80	N/A	2
	Spent acid with metals	Fabricated metal products, nec, Plating and polishing	4500 G	DK	80	N/A	2
	Spent acid with metals	Fabricated metal products, nec, Power transmission equipment, nec,Farm machinery and equipment	1500 T	present	present	DK	2
	Spent acid with metals	Fabricated plate work,Sheet metal work, Fabricated metal products, nec	11300 G	15	50	0	4
	Spent acid with metals	Fabricated structural metal	97433 G	15	present	DK	2
	Spent acid with metals	Farm machinery and equipment	58 T	DK	DK	DK	2
	Spent acid with metals	Guided missiles and space vehicles, Aircraft, Aircraft equipment, nec	DK	3	70	N/A	2
	Spent acid with metals	Hand and edge tools, nec, Hand saws and saw blades, Machine tool accessories	835 G	DK	DK	1	12
	Spent acid with metals	Hardware, nec, Aircraft equipment, nec, Fabricated metal products, nec	8650 G	29	74	DK	3
	Spent acid with metals	Household cooking equipment	22644000 G	0.1	98	DK	2
	Spent acid with metals	Industrial inorganic chemicals, nec	20 T	DK	present	DK	6.5
	Spent acid with metals	Iron ores	3650 G	present	90	N/A	8
	Spent acid with metals	Lithographic platemaking services, Photoengraving, Engraving and plate printing	1 T	present	present	DK	2
	Spent acid with metals	Lithographic platemaking services, Photoengraving, Engraving and plate printing	15 T	present	present	DK	2
	Spent acid with metals	Measuring and controlling devices, nec	DK	present	5	DK	2
	Spent acid with metals	Metal coating and allied services	1339 T	DK	80	DK	2
	Spent acid with metals	Metal coating and allied services	1468 T	4	96	0	2
	Spent acid with metals	Metal coating and allied services	270 T	9	80	DK	2
	Spent acid with metals	Metal coating and allied services	1025879 T	present	98	DK	6
	Spent acid with metals	miscellaneous fabricated wire products	7500 G	6	94	0	2
	Spent acid with metals	Miscellaneous metal work	8 T	DK	99	DK	2
	Spent acid with metals	Miscellaneous metal work	DK	N/A	N/A	N/A	7.7
	Spent acid with metals	Miscellaneous plastics products	3500 G	5	90	DK	2
	Spent acid with metals	Motor vehicles and car bodies	14815 G	12	98	0	3
	Spent acid with metals	National security	255 G	0	present	0	2
	Spent acid with metals	National security	75 G	N/A	N/A	N/A	2
	Spent acid with metals	National security	0	DK	DK	DK	2
	Spent acid with metals	Nonclassifiable establishment	1155 G	present	present	DK	3
	Spent acid with metals	Paper industries machinery, Machinery, except electrical, nec	220 G	DK	85	0	2.2
	Spent acid with metals	Photoengraving	9900 G	30	70	0	8.5
	Spent acid with metals	Photographic equipment and supplies	3 T	N/A	80	0	2
	Spent acid with metals	Plating and polishing	204000 G	DK	DK	0	2
	Spent acid with metals	Plating and polishing	19040 G	1	DK	DK	2
	Spent acid with metals	Plating and polishing	400 G	DK	DK	DK	2
	Spent acid with metals	Plating and polishing	300 G	5	80	DK	2
	Spent acid with metals	Plating and polishing	50 G	5	80	DK	2
	Spent acid with metals	Plating and polishing	1155 G	DK	80	DK	2
	Spent acid with metals	Plating and polishing	5 T	0	78	DK	2.5
	Spent acid with metals	Plating and polishing	245 T	DK	DK	DK	3.6
	Spent acid with metals	Plating and polishing	8 T	DK	99	DK	4
	Spent acid with metals	Plating and polishing	6826200 G	1	90	0	4
	Spent acid with metals	Plating and polishing	5550 G	DK	99	DK	4
	Spent acid with metals	Plating and polishing	3 T	0	80	DK	4.5

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic liquids (continued)	Other inorganic sludge	Steel pipe and tubes	4400 G	10	86	0	10
	Other inorganic sludge	Tanks and tank components	26 T	30	70	DK	12
Inorganic liquids	Spent acid with metals	Aircraft	54 T	DK	DK	N/A	2
	Spent acid with metals	Aircraft	6 T	DK	DK	N/A	2
	Spent acid with metals	Aircraft	332 G	DK	DK	N/A	2
	Spent acid with metals	Aircraft	10 T	64	DK	N/A	12
	Spent acid with metals	Aircraft	47 T	64	DK	N/A	12
	Spent acid with metals	Aircraft	80 G	64	DK	N/A	12
	Spent acid with metals	Aircraft engines and engine parts	9072 T	1	DK	DK	2
	Spent acid with metals	Aircraft engines and engine parts	216 G	2	DK	DK	2
	Spent acid with metals	Aircraft engines and engine parts	1104	DK	DK	DK	2
	Spent acid with metals	Aircraft engines and engine parts	20985 G	8	80	DK	4
	Spent acid with metals	Aircraft engines and engine parts	5305 G	8	80	DK	4
	Spent acid with metals	Aircraft engines and engine parts	98 G	DK	DK	DK	12
	Spent acid with metals	Aluminum rolling and drawing, nec, Aluminum extruded products	26 T	DK	86	DK	2
	Spent acid with metals	Aluminum rolling and drawing, nec, Aluminum extruded products	7 T	DK	90	DK	2
	Spent acid with metals	Ammunition, except for small arms, nec	78 T	DK	80	DK	2
	Spent acid with metals	Ammunition, except for small arms, nec,Metal stampings, nec, Metal coating and allied services	205808 T	1	99	1	4
	Spent acid with metals	Automotive stampings	6 T	80	16	present	2
	Spent acid with metals	Blast furnaces and steel mills	3388 T	5	95	0	12
	Spent acid with metals	Bolts, nuts, rivets, and washers	27600 G	25	72	N/A	8
	Spent acid with metals	Book printing	110 G	DK	DK	DK	4
	Spent acid with metals	Chemical preparations, nec, Metal coating and allied services,Fabricated metal products, nec	12780 G	DK	90	DK	2
	Spent acid with metals	Coating, engraving, and allied services	3600 G	DK	90	DK	2
	Spent acid with metals	Colleges and universities,nec, Medical laboratories	308 G	DK	DK	DK	2
	Spent acid with metals	Commercial printing, gravure	580 T	2	98	1	2
	Spent acid with metals	Construction machinery	2400 G	2	98	DK	2
	Spent acid with metals	Costume jewelry	58 G	10	30	DK	2
	Spent acid with metals	Costume jewelry	165 G	25	40	DK	4
	Spent acid with metals	Current-carrying wiring devices	55 G	1	DK	DK	2
	Spent acid with metals	Current-carrying wiring devices,Electron tubes, transmitting,Electronic components, nec	71900 G	10	89	0	2
	Spent acid with metals	Cyclic crudes and intermediates,Industrial organic chemicals, nec	27489 T	1	95	1	2
	Spent acid with metals	DK	326584 G	29	70	present	2
	Spent acid with metals	DK	0	DK	present	0	2
	Spent acid with metals	DK	DK	DK	DK	DK	6
	Spent acid with metals	DK	41 T	99	1	0	7
	Spent acid with metals	Electric services	514100 G	1	99	N/A	2
	Spent acid with metals	Electric services	400000 G	1	99	N/A	2
	Spent acid with metals	Electric services	200000 G	1	99	N/A	2
	Spent acid with metals	Electric services	16751 T	DK	99	DK	2
	Spent acid with metals	Electric services	1972758 G	DK	DK	DK	2
	Spent acid with metals	Electric services	1000000 G	1	99	0	2
	Spent acid with metals	Electric services	0	DK	DK	N/A	4
	Spent acid with metals	Electrometallurgical products	41000 G	DK	DK	DK	2
	Spent acid with metals	Electronic	65 G	DK	DK	DK	2
	Spent acid with metals	Electronic components, nec	150 G	DK	DK	0	2
	Spent acid with metals	Electronic components, nec	5 T	0	75	0	2
	Spent acid with metals	Electronic components, nec	5340 G	5	93	1	2
	Spent acid with metals	Electronic components, nec	39 T	5	DK	DK	2
	Spent acid with metals	Electronic components, nec	49798 G	0	90	present	2
	Spent acid with metals	Electronic components, nec	5 G	DK	DK	DK	2
	Spent acid with metals	Electronic components, nec	643 G	0	75	present	2
	Spent acid with metals	Electronic components, nec	80 G	N/A	75	present	2
	Spent acid with metals	Electronic components, nec	257 G	N/A	95	N/A	2
	Spent acid with metals	Electronic components, nec	60 G	N/A	90	N/A	2
	Spent acid with metals	Electronic components, nec	521 G	N/A	90	N/A	2
	Spent acid with metals	Electronic components, nec	343 G	N/A	90	DK	2
	Spent acid with metals	Electronic components, nec	194 G	N/A	80	N/A	2
	Spent acid with metals	Electronic components, nec	50 G	1	98	DK	2
	Spent acid with metals	Electronic components, nec	5200 G	10	90	N/A	2
	Spent acid with metals	Electronic components, nec	16392 G	1	98	0.5	2.9

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic liquids	Other aqueous waste with high dissolved solids	Agricultural chemicals, nec	8140 T	17	78	N/A	12
	Other aqueous waste with high dissolved solids	Chemical preparations, nec	1072500 G	present	90	N/A	12
	Other aqueous waste with high dissolved solids	Cyclic crudes and intermediates	3642 T	10	88	present	2
	Other aqueous waste with high dissolved solids	DK	352 T	16	84	0	9
	Other aqueous waste with high dissolved solids	Electrical equipment and supplies, nec	22823 G	5	95	0	9
	Other aqueous waste with high dissolved solids	Engineering and scientific instruments, Surgical and medical instruments	78 G	1	80	1	12
	Other aqueous waste with high dissolved solids	General chemical manufacturing	250000 G	20	80	5	9
	Other aqueous waste with high dissolved solids	Industrial inorganic and organic chemicals, nec, Nitrogenous fertilizers	DK	present	present	DK	10
	Other aqueous waste with high dissolved solids	Metal coating and allied services	80 T	1	99	1	12
	Other aqueous waste with high dissolved solids	Plating and polishing,Metal coating and allied services, Coating, engraving, and allied services	20000 G	present	present	present	9
	Other aqueous waste with high dissolved solids	Refuse systems	418 T	20	80	5	11
Inorganic liquids	Other inorganic liquid	Agricultural chemicals, nec, Organic pesticide products, Water supply	100000 G	1	99	present	7
	Other inorganic liquid	Air, water, and solid waste management	23 T	DK	99	1	9
	Other inorganic liquid	Aircraft engines and engine parts	48 G	2	DK	DK	2
	Other inorganic liquid	Ammunition, except for small arms, nec	DK	present	present	DK	12
	Other inorganic liquid	Biological products	120 G	DK	75	N/A	7.5
	Other inorganic liquid	Blast furnaces and steel mills	20 T	DK	DK	DK	3
	Other inorganic liquid	Chemical preparations, nec	24 T	0	81	N/A	4
	Other inorganic liquid	Chemical preparations, nec, Industrial inorganic chemicals, nec	80 T	2	98	DK	2
	Other inorganic liquid	DK	646325 G	20	80	N/A	7
	Other inorganic liquid	Electron tubes, transmitting, X-ray apparatus and tubes	7014 T	2	98	DK	2
	Other inorganic liquid	Electronic components, nec	10 G	DK	DK	DK	2
	Other inorganic liquid	Electronic components, nec	120 G	1	10	N/A	12
	Other inorganic liquid	Electronic components, nec	2645 G	DK	DK	DK	12
	Other inorganic liquid	Electronic connectors	38 G	N/A	N/A	DK	2
	Other inorganic liquid	Engineering and scientific instruments	39068560 G	DK	DK	DK	7
	Other inorganic liquid	Fabricated structural metal	9720 G	15	present	DK	3
	Other inorganic liquid	Industrial inorganic chemicals, nec, Chemical preparations, nec	48 T	2	98	DK	12
	Other inorganic liquid	Industrial organic chemicals, nec	4760000 G	0	99	0	2
	Other inorganic liquid	Machinery, except electrical, nec	4775000 G	present	99	N/A	3
	Other inorganic liquid	Miscellaneous metal work	9900 G	5	90	DK	8.5
	Other inorganic liquid	Motor vehicles and car bodies	440 G	DK	DK	N/A	2
	Other inorganic liquid	Nitrogenous fertilizers	1398783 T	0	0	DK	7
	Other inorganic liquid	Ordinance and accessories, nec	55 G	DK	DK	DK	2
	Other inorganic liquid	Pens and mechanical pencils, Plating and polishing	825000 G	present	99	0	2
	Other inorganic liquid	Pharmaceutical preparations,Drugs, proprietaries, and sundries,Research and development labs	631400 G	0	97	9	12
	Other inorganic liquid	Power driven hand tools	6400 G	3	DK	N/A	6
	Other inorganic liquid	Railroads, line-haul operating, Railroad equipment	58300 G	present	87	0	12.5
	Other inorganic liquid	Research and development laboratories	2550000 G	DK	99	DK	7
	Other inorganic liquid	Services, nec, Chemicals and allied products	880 T	1	99	DK	3
	Other inorganic liquid	Water supply	1 T	DK	DK	N/A	10
Inorganic liquids	Other inorganic sludge	Aircraft	275 G	98	DK	DK	7
	Other inorganic sludge	Aircraft engines and engine parts	744 G	DK	DK	DK	2
	Other inorganic sludge	Aircraft engines and engine parts	5800 G	50	50	DK	4
	Other inorganic sludge	Aircraft engines and engine parts	150 G	50	50	DK	4
	Other inorganic sludge	Aircraft engines and engine parts	72 G	DK	DK	DK	12
	Other inorganic sludge	Aircraft equipment, nec	5000 G	98	DK	DK	12
	Other inorganic sludge	Aircraft, Space propulsion units and parts	1540 G	80	DK	DK	2
	Other inorganic sludge	Blast furnaces and steel mills	41 T	32	50	0.003	2
	Other inorganic sludge	Electronic components, nec	118 G	N/A	60	DK	2
	Other inorganic sludge	Fabricated metal products, nec	0	98	2	DK	12
	Other inorganic sludge	Household appliances, nec, Household cooking equipment, Household refrigerators and freezers	87 T	60	DK	N/A	4
	Other inorganic sludge	Industrial inorganic chemicals, nec	12 T	98	0	present	3
	Other inorganic sludge	Industrial organic chemicals, nec, Cyclic crudes and intermediates,Synthetic rubber	171 T	20	80	present	2
	Other inorganic sludge	Petroleum refining	864 T	52	48	N/A	12
	Other inorganic sludge	Plating and polishing	9 T	25	75	DK	3
	Other inorganic sludge	Sanitary services, nec	55 G	92	8	N/A	2
	Other inorganic sludge	Sanitary services, nec	1 T	99	1	N/A	11
	Other inorganic sludge	Space research and technology	3 G	70	0	DK	2
	Other inorganic sludge	Steel pipe and tubes	216 G	44	N/A	N/A	2

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Inorganic liquids (continued)	Caustic solution with metals but no cyanides	Electronic components, nec	408 T	80	60	1	9
	Caustic solution with metals but no cyanides	Electronic components, nec	553 T	1	present	N/A	9
	Caustic solution with metals but no cyanides	Electronic components, nec	46 T	DK	DK	DK	10
	Caustic solution with metals but no cyanides	Electronic components, nec	3656 G	DK	80	DK	10
	Caustic solution with metals but no cyanides	Electronic components, nec	1600 G	present	70	present	11
	Caustic solution with metals but no cyanides	Electronic components, nec	72 T	DK	DK	DK	11
	Caustic solution with metals but no cyanides	Electronic components, nec	480 G	DK	present	DK	12
	Caustic solution with metals but no cyanides	Electronic components, nec	211 G	N/A	90	N/A	12
	Caustic solution with metals but no cyanides	Electronic components, nec	60 G	N/A	95	N/A	12
	Caustic solution with metals but no cyanides	Electronic computing equipment	9000 G	present	99	present	10
	Caustic solution with metals but no cyanides	Electronic computing equipment	4943 G	present	80	N/A	10
	Caustic solution with metals but no cyanides	Electronic resistors	495 G	13	87	N/A	12
	Caustic solution with metals but no cyanides	Environmental controls	2310 G	17	80	DK	12
	Caustic solution with metals but no cyanides	Fabricated metal products, nec	10950 G	0	98	DK	7
	Caustic solution with metals but no cyanides	Fabricated metal products, nec	9910 G	44	56	DK	10
	Caustic solution with metals but no cyanides	Industrial supplies	39 T	60	40	DK	12
	Caustic solution with metals but no cyanides	Instruments to measure electricity, Process control instruments	4845 G	present	93	DK	8
	Caustic solution with metals but no cyanides	Internal combustion engines, nec, Manufacturing industries, nec	1324000 G	25	55	1	12
	Caustic solution with metals but no cyanides	Manufacturing industries, nec	2585 G	DK	90	N/A	2
	Caustic solution with metals but no cyanides	Manufacturing industries, nec, Electronic components, nec, Current-carrying wiring devices	4850 G	15	40	N/A	8
	Caustic solution with metals but no cyanides	Metal coating and allied services	218 T	2	98	0	10
	Caustic solution with metals but no cyanides	Metal coating and allied services, Tanks and tank components, Transportation equipment, nec	11 T	present	present	present	12.5
	Caustic solution with metals but no cyanides	Metal heat treating, Steel wire and related products	254 G	present	present	present	2
	Caustic solution with metals but no cyanides	miscellaneous fabricated wire products	3650 G	5	95	0	12
	Caustic solution with metals but no cyanides	Miscellaneous metal work	3 T	DK	99	DK	8
	Caustic solution with metals but no cyanides	Miscellaneous metal work, Metal coating and allied services, Aircraft	13 T	present	present	N/A	5
	Caustic solution with metals but no cyanides	Motor vehicle parts and accessories	33 T	DK	70	DK	12
	Caustic solution with metals but no cyanides	Motors and generators	55 G	DK	DK	DK	6.8
	Caustic solution with metals but no cyanides	National security	831 G	0	0	0	10
	Caustic solution with metals but no cyanides	National security	1 T	0	0	DK	12
	Caustic solution with metals but no cyanides	National security, Plating and polishing,Metal coating and allied services	8075 G	present	present	N/A	11
	Caustic solution with metals but no cyanides	Plating and polishing	18 T	DK	99	DK	8
	Caustic solution with metals but no cyanides	Plating and polishing	84300 G	DK	DK	DK	10
	Caustic solution with metals but no cyanides	Plating and polishing	DK	20	80	N/A	10
	Caustic solution with metals but no cyanides	Plating and polishing	4000 G	10	90	N/A	10
	Caustic solution with metals but no cyanides	Plating and polishing	220 G	present	90	N/A	10
	Caustic solution with metals but no cyanides	Plating and polishing	2250 G	N/A	N/A	N/A	11
	Caustic solution with metals but no cyanides	Plating and polishing	2476 G	0	92	DK	12
	Caustic solution with metals but no cyanides	Plating and polishing	5250 G	DK	DK	DK	12
	Caustic solution with metals but no cyanides	Plating and polishing	10000 G	DK	90	present	12
	Caustic solution with metals but no cyanides	Plating and polishing, Electronic components, nec	8000 G	DK	95	N/A	2
	Caustic solution with metals but no cyanides	Plating and polishing, Electronic components, nec	840 G	DK	98	N/A	12
	Caustic solution with metals but no cyanides	Plating and polishing,Metal coating and allied services, Electronic components, nec	5190 G	1	99	0	12
	Caustic solution with metals but no cyanides	Plating and polishing,Metal household furniture, Metal office furniture	213600 G	5	95	N/A	12
	Caustic solution with metals but no cyanides	Primary metal products, nec	40800 G	DK	DK	DK	7.2
	Caustic solution with metals but no cyanides	Radio and TV communication equipment	99 T	15	85	DK	10
	Caustic solution with metals but no cyanides	Radio and TV communication equipment	1250 G	DK	DK	DK	11
	Caustic solution with metals but no cyanides	Radio and TV communication equipment,Electronic components, nec	12 T	DK	83	0	10
	Caustic solution with metals but no cyanides	Research and development laboratories	400 G	4	96	0	12
	Caustic solution with metals but no cyanides	Semiconductors and related devices	220 G	5	90	DK	10
	Caustic solution with metals but no cyanides	Semiconductors and related devices, Electron tubes, receiving type, Electronic connectors	1 T	15	80	DK	8
	Caustic solution with metals but no cyanides	Semiconductors and related devices, Electron tubes, receiving type, Electronic connectors	4 T	60	35	DK	9
	Caustic solution with metals but no cyanides	Ship building and repairing	35200 G	DK	DK	DK	9.8
	Caustic solution with metals but no cyanides	Speed changers, drives, and gears, Aircraft equipment	15284 G	DK	90	DK	10
	Caustic solution with metals but no cyanides	Steel pipe and tubes	153 T	12	88	DK	10
	Caustic solution with metals but no cyanides	Steel pipe and tubes	3794 G	15	DK	DK	12
	Caustic solution with metals but no cyanides	Tanks and tank components	1 T	15	85	DK	12
	Caustic solution with metals but no cyanides	Telephone and telegraph apparatus, Semiconductors and related devices,Radio and TV communication eq	4300 G	40	60	0	9
	Caustic solution with metals but no cyanides	Telephone and telegraph apparatus, Semiconductors and related devices,Radio and TV communication eq	440 G	10	79	0	10
	Caustic solution with metals but no cyanides	Telephone communication	2 T	5	95	DK	12
	Caustic solution with metals but no cyanides	Turbines and turbine generator sets	12400 G	DK	DK	DK	8.2

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous inorganic liquids (continued)	Wastewater or aqueous mixture	Pharmaceutical preparations	1763000 G	5	95	DK	4
	Wastewater or aqueous mixture	Plastics materials and resins	258438 T	5	95	DK	9.5
	Wastewater or aqueous mixture	Plating and polishing	16602400 G	0	99	DK	5
	Wastewater or aqueous mixture	Plating and polishing	19996685 G	0	99	DK	5
	Wastewater or aqueous mixture	Plating and polishing	1440000 G	1	99	N/A	6.5
	Wastewater or aqueous mixture	Plating and polishing	1234840 G	1	99	N/A	6.5
	Wastewater or aqueous mixture	Plating and polishing	5000000 G	present	95	present	9
	Wastewater or aqueous mixture	Plating and polishing, Jewelry, precious metal	6376138 G	1	99	0	2
	Wastewater or aqueous mixture	Plating and polishing, Jewelry, precious metal	36000 G	6	94	DK	12
	Wastewater or aqueous mixture	Pressed and blown glass, nec, Electric lamps	4807000 G	present	present	present	8
	Wastewater or aqueous mixture	Primary metal products, nec, Electronic components, nec, Fabricated metal products, nec	6 T	present	present	DK	8
	Wastewater or aqueous mixture	Secondary nonferrous metals, Motor vehicle parts and accessories	6086000 G	DK	98	present	2
	Wastewater or aqueous mixture	Semiconductors and related devices	84000000 G	1	99	1	2
	Wastewater or aqueous mixture	Semiconductors and related devices	143530 T	DK	99	DK	7
	Wastewater or aqueous mixture	Semiconductors and related devices	70 G	DK	99	DK	7
	Wastewater or aqueous mixture	Surface active agents,Industrial organic chemicals, nec	55818 G	10	80	10	2
	Wastewater or aqueous mixture	Switchgear and switchboard apparatus	17400000 G	0	99	0	2
	Wastewater or aqueous mixture	Tanks and tank components	123 T	4	96	DK	11
	Wastewater or aqueous mixture	Valves and pipe fittings	250 G	DK	95	DK	11
Contaminated soil	Contaminated soil or cleanup residue	Electronic components, nec	6 T	98	2	DK	8
	Contaminated soil or cleanup residue	Miscellaneous plastics products, Plastics materials and resins	41 T	2	18	DK	9
Contaminated soil	Soil contaminated with inorganics only	Industrial inorganic chemicals, nec	455 T	99	1	N/A	2
	Soil contaminated with inorganics only	Industrial inorganic chemicals, nec	2311 T	90	10	DK	2
	Soil contaminated with inorganics only	Industrial organic chemicals, nec	1 T	99	N/A	N/A	2
	Soil contaminated with inorganics only	Manufacturing industries, nec	1 T	95	2	0	4
Contaminated soil	Soil contaminated with organics	Miscellaneous plastics products, Sporting and athletic goods, nec	0	99	1	0	8
	Soil contaminated with organics	Synthetic rubber	259 T	95	5	1	2
Inorganic liquids	Caustic solution with metals and cyanides	Electronic components, nec	7066 G	6	94	1	10
	Caustic solution with metals and cyanides	Electronic computing equipment	1 T	50	DK	DK	12
	Caustic solution with metals and cyanides	Plating and polishing,Metal coating and allied services, Electronic components, nec	80 G	1	90	0	10
	Caustic solution with metals and cyanides	Telephone communication	165 G	11	87	0	12
Inorganic liquids	Caustic solution with metals but no cyanides	Aircraft	47 T	34	DK	N/A	11
	Caustic solution with metals but no cyanides	Aircraft	38 T	80	20	N/A	12
	Caustic solution with metals but no cyanides	Aircraft engines and engine parts	240 G	1	DK	DK	12
	Caustic solution with metals but no cyanides	Aircraft equipment, nec	0	5.4	DK	UK	10
	Caustic solution with metals but no cyanides	Aircraft equipment, nec, Miscellaneous metal work, Fabricated metal products, nec	48 G	6	4	DK	2
	Caustic solution with metals but no cyanides	Aluminum extruded products	29560 G	20	80	N/A	12
	Caustic solution with metals but no cyanides	Aluminum rolling and drawing, nec, Aluminum extruded products	178 T	DK	90	DK	9
	Caustic solution with metals but no cyanides	Automotive stampings, Metal coating and allied services	4 T	98	2	present	6
	Caustic solution with metals but no cyanides	Current-carrying wiring devices	1300 G	0	80	0	9
	Caustic solution with metals but no cyanides	Current-carrying wiring devices,Electron tubes, transmitting,Electronic components, nec	61200 G	10	88	0	11
	Caustic solution with metals but no cyanides	Cutlery	4444 G	DK	present	DK	10
	Caustic solution with metals but no cyanides	Cyclic crudes and intermediates,Industrial organic chemicals, nec	96200 T	1	95	1	11
	Caustic solution with metals but no cyanides	DK	3876000 G	2	97	N/A	12
	Caustic solution with metals but no cyanides	Electrical equipment and supplies, nec	11395 G	1	98	0	8
	Caustic solution with metals but no cyanides	Electron tubes, transmitting	700 G	present	99	DK	12
	Caustic solution with metals but no cyanides	Electronic components, nec	3636 G	2	70	DK	2
	Caustic solution with metals but no cyanides	Electronic components, nec	86676 G	present	present	DK	5
	Caustic solution with metals but no cyanides	Electronic components, nec	DK	17	DK	DK	8
	Caustic solution with metals but no cyanides	Electronic components, nec	25500 G	0	99	DK	8
	Caustic solution with metals but no cyanides	Electronic components, nec	559 T	DK	DK	DK	8
	Caustic solution with metals but no cyanides	Electronic components, nec	121 T	20	80	DK	8
	Caustic solution with metals but no cyanides	Electronic components, nec	16885 G	20	70	0	8.8
	Caustic solution with metals but no cyanides	Electronic components, nec	20975 G	present	90	0	9
	Caustic solution with metals but no cyanides	Electronic components, nec	36000 G	N/A	present	DK	9
	Caustic solution with metals but no cyanides	Electronic components, nec	4 T	DK	60	DK	9
	Caustic solution with metals but no cyanides	Electronic components, nec	31 T	90	60	1	9

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous inorganic liquids (continued)	Caustic Aqueous waste	Primary batteries, dry and wet	180 G	present	99	DK	10
	Caustic Aqueous waste	Primary batteries, dry and wet	2 T	DK	DK	DK	11
	Caustic Aqueous waste	Primary batteries, dry and wet, Storage batteries	11000 G	45	55	DK	12
	Caustic Aqueous waste	Radio and TV communication equipment, Aircraft equipment, nec	40 T	15	80	3	12
	Caustic Aqueous waste	Repair services, nec	2500 G	2	97	DK	10
	Caustic Aqueous waste	Repair services, nec, Paints and allied products	1250000 G	20	80	DK	11
	Caustic Aqueous waste	Research and development laboratories	110 G	DK	present	DK	9
	Caustic Aqueous waste	Research and development laboratories	9370 G	5	75	N/A	10
	Caustic Aqueous waste	Research and development laboratories	201 T	15	85	DK	12
	Caustic Aqueous waste	Semiconductors and related devices	315 G	1	70	1	12
	Caustic Aqueous waste	Semiconductors and related devices	22410 G	0	90	present	12
	Caustic Aqueous waste	Ship building and repairing	11904 G	DK	99	DK	9.9
	Caustic Aqueous waste	Ship building and repairing	238000 G	0	90	0	12
	Caustic Aqueous waste	Space research and technology	1500 G	10	80	DK	12
	Caustic Aqueous waste	Space research and technology, Photofinishing laboratories	2750 G	present	present	DK	12
	Caustic Aqueous waste	Switching and terminal devices	275000 G	DK	DK	DK	11
	Caustic Aqueous waste	Tanks and tank components	20 T	5	95	2	12
	Caustic Aqueous waste	Telephone and telegraph apparatus,Semiconductors and related devices	660 G	1	98	DK	12
	Caustic Aqueous waste	Trucking, except local	938000 G	DK	DK	DK	12
	Caustic Aqueous waste	Valves and pipe fittings	2700 G	DK	95	DK	12
	Caustic Aqueous waste	DK	1850 G	99	1	10	2
Aqueous inorganic liquids	Other aqueous waste with low dissolved solids	Cyclic crudes and intermediates	310000 G	0	99	0	2
	Other aqueous waste with low dissolved solids	Cyclic crudes and intermediates	1044400 G	1	99	1	7
	Other aqueous waste with low dissolved solids	DK	34 T	5	95	1	2
	Other aqueous waste with low dissolved solids	Electrical equipment and supplies, nec	64773 T	0	99	0	10
	Other aqueous waste with low dissolved solids	Fabricated metal products, nec	935 G	DK	95	DK	6
	Other aqueous waste with low dissolved solids	Fabricated rubber products, nec	99182 T	40	60	N/A	8
	Other aqueous waste with low dissolved solids	Guided missiles and space vehicles, Aircraft, Aircraft equipment, nec	143 T	N/A	98	0	7
	Other aqueous waste with low dissolved solids	Industrial inorganic chemicals, nec	187426 T	1	99	1	7
	Other aqueous waste with low dissolved solids	Nitrogenous fertilizers	9081245 G	1	99	DK	7.4
	Other aqueous waste with low dissolved solids	Nitrogenous fertilizers	4020672 G	1	99	DK	8
	Other aqueous waste with low dissolved solids	Nitrogenous fertilizers	365000 G	0.1	99	DK	8
	Other aqueous waste with low dissolved solids	Plating and polishing, Aircraft equipment	221 T	DK	80	N/A	2
	Other aqueous waste with low dissolved solids	Semiconductors and related devices, Electron tubes, receiving type, Electronic connectors	532078 T	1	99	DK	2
	Other aqueous waste with low dissolved solids	Services, nec	386 G	10	90	DK	8
Aqueous inorganic liquids	Scrubber water	Cyclic crudes and intermediates,Industrial organic chemicals, nec,Nitrogenous fertilizers	32676 T	0.8	99	N/A	2
	Scrubber water	Fabricated metal products, nec, Miscellaneous metal work	71250 G	20	70	N/A	9
	Scrubber water	Industrial organic chemicals, nec	2490 T	7	93	0	8
	Scrubber water	Manufacturing industries, nec	14000000 G	1	100	DK	7
	Scrubber water	Research and development laboratories	4896 G	15	85	0	7
Aqueous inorganic liquids	Wastewater or aqueous mixture	Coating, engraving, and allied services	122 T	DK	DK	DK	9
	Wastewater or aqueous mixture	DK	1150 G	N/A	N/A	N/A	2
	Wastewater or aqueous mixture	Electronic components, nec	110 G	0	85	0	4
	Wastewater or aqueous mixture	Electronic components, nec, Semiconductors and related devices, Electronic parts and equipment	180 G	10	60	0	4.3
	Wastewater or aqueous mixture	Fabricated metal products, nec, Metal office furniture, Public building and related furniture	360000 G	2	90	1	4
	Wastewater or aqueous mixture	General chemical manufacturing, Industrial inorganic chemicals, nec	615 G	1	98	0.6	4
	Wastewater or aqueous mixture	General chemical manufacturing, Soap and other detergents	615 G	1	99	0.4	4
	Wastewater or aqueous mixture	Industrial inorganic chemicals, nec	682419 G	10	90	0	7
	Wastewater or aqueous mixture	Industrial organic chemicals, nec	840 T	present	99	present	7
	Wastewater or aqueous mixture	Industrial organic chemicals, nec	75737 G	present	99	present	7
	Wastewater or aqueous mixture	Industrial organic chemicals, nec	17826 T	present	96	4	7.2
	Wastewater or aqueous mixture	Industrial organic chemicals, nec, Industrial inorganic chemicals, nec	482 T	17	99	0.1	10
	Wastewater or aqueous mixture	Marine cargo handling	1891567	2	98	DK	12
	Wastewater or aqueous mixture	Metals service centers and offices	100000 G	2	98	1	7
	Wastewater or aqueous mixture	Nitrogenous fertilizers	5000 G	1	99	DK	7
	Wastewater or aqueous mixture	Nonferrous rolling and drawing, nec, Metal stampings, nec, Fabricated metal products, nec	5 G	present	DK	DK	2
	Wastewater or aqueous mixture	Nonferrous wire drawing and insulating	44660 T	0	99	N/A	2
	Wastewater or aqueous mixture	Ordinance and accessories, nec	4076000 G	1	99	N/A	3
	Wastewater or aqueous mixture	Paints and allied products	2069541 G	DK	95	DK	12
	Wastewater or aqueous mixture	Pharmaceutical preparations	1763000 G	5	95	DK	4

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous Inorganic liquids (continued)	Caustic Aqueous waste	Electric services	55 G	1	99	DK	10
	Caustic Aqueous waste	Electric services	1000000 G	1	99	1	12
	Caustic Aqueous waste	Electronic components, nec	48 G	0	50	0	12
	Caustic Aqueous waste	Electronic components, nec	216000 G	2	98	0	12
	Caustic Aqueous waste	Electronic computing equipment	95636 G	5	90	DK	8
	Caustic Aqueous waste	Electronic computing equipment	13 T	10	90	N/A	12
	Caustic Aqueous waste	Fabricated metal products, nec	270000 G	1	99	0	7
	Caustic Aqueous waste	Fabricated metal products, nec	DK	DK	DK	DK	12
	Caustic Aqueous waste	Fabricated metal products, nec, Screw machine products	400 G	5	90	N/A	12
	Caustic Aqueous waste	Fluid meters and counting devices	140 G	present	50	DK	11
	Caustic Aqueous waste	General chemical manufacturing	32 T	11	89	N/A	12
	Caustic Aqueous waste	General crop services	68395 T	2	98	0.1	12
	Caustic Aqueous waste	Heating equipment, except electric, Fabricated metal products, nec	1595 G	present	95	N/A	11
	Caustic Aqueous waste	Household refrigerators and freezers	1 T	DK	25	DK	3
	Caustic Aqueous waste	Industrial controls	18 T	5	95	DK	12
	Caustic Aqueous waste	Industrial gases	1 T	0	90	0	7
	Caustic Aqueous waste	Industrial organic chemicals, nec	210000 G	0	99	0	10
	Caustic Aqueous waste	Industrial organic chemicals, nec	580000 G	0	99	0	10
	Caustic Aqueous waste	Industrial organic chemicals, nec	168000 G	0	99	0	11
	Caustic Aqueous waste	Industrial organic chemicals, nec	0	DK	75	N/A	12
	Caustic Aqueous waste	Industrial organic chemicals, nec	2328 T	present	present	0	12.5
	Caustic Aqueous waste	Industrial organic chemicals, nec,Agricultural chemicals, nec, Cyclic crudes and Intermediates	4350000 G	1	99	1	10
	Caustic Aqueous waste	Industrial organic chemicals, nec,Agricultural chemicals, nec, Plastics materials and resins	4 T	present	present	present	2
	Caustic Aqueous waste	Industrial organic chemicals, nec,Agricultural chemicals, nec, Plastics materials and resins	6 T	present	present	present	2
	Caustic Aqueous waste	Industrial organic chemicals, nec,Plastics materials and resins	4 T	present	present	present	2
	Caustic Aqueous waste	Instruments to measure electricity, Process control instruments	2805 G	present	99	DK	11
	Caustic Aqueous waste	Lubricating oils and greases	15000 G	DK	95	DK	12
	Caustic Aqueous waste	Machine tools, metal cutting types,Special dies, tools,jigs, and fixture,Machine tool accessories	55 G	1	97	DK	12
	Caustic Aqueous waste	Metal coating and allied services	338700 G	1	99	0	8
	Caustic Aqueous waste	Metal coating and allied services	202100 G	1	99	0	8
	Caustic Aqueous waste	Metal coating and allied services	648752 T	present	99	DK	8
	Caustic Aqueous waste	Metal coating and allied services	DK	31	DK	DK	12
	Caustic Aqueous waste	Metal coating and allied services, Coating, engraving, and allied services	7150 G	DK	98	DK	10
	Caustic Aqueous waste	Metal coating and allied services, Coating, engraving, and allied services	660 G	DK	75	DK	11
	Caustic Aqueous waste	Metal coating and allied services, Coating, engraving, and allied services	513 G	DK	90	DK	11
	Caustic Aqueous waste	Metal office furniture, Metal partitions and fixtures, Furniture and fixtures, nec	550 G	present	present	present	12
	Caustic Aqueous waste	Metal stampings, nec, Sheet metal work, Metal barrels, drums, and pails	0	0	98	1	12
	Caustic Aqueous waste	Metal working machinery, nec	250 G	1	99	N/A	2
	Caustic Aqueous waste	Metal working machinery, nec	300 G	DK	DK	DK	2
	Caustic Aqueous waste	miscellaneous fabricated wire products	6508 T	DK	90	DK	12
	Caustic Aqueous waste	Miscellaneous metal work	20000 G	5	90	DK	5
	Caustic Aqueous waste	Motor vehicle parts and accessories	DK	N/A	30	DK	12
	Caustic Aqueous waste	Motor vehicles and car bodies	23200 G	DK	DK	DK	12
	Caustic Aqueous waste	Motors and generators	30 G	DK	DK	DK	12
	Caustic Aqueous waste	Motors and generators, Motor vehicle parts and accessories	2 T	10	90	N/A	12
	Caustic Aqueous waste	National security	7 T	0	90	N/A	11
	Caustic Aqueous waste	National security	0	DK	DK	DK	12
	Caustic Aqueous waste	National security	1 T	0	75	DK	12
	Caustic Aqueous waste	National security	1 T	0	75	DK	12
	Caustic Aqueous waste	National security	2 T	0	90	N/A	12
	Caustic Aqueous waste	National security	415214 G	5	95	1	12
	Caustic Aqueous waste	National security	2640 G	1	99	0	12.5
	Caustic Aqueous waste	Noncommercial research organizations	1 T	15	75	N/A	2.2
	Caustic Aqueous waste	Organic pesticide products	120000 G	DK	95	DK	12
	Caustic Aqueous waste	Organic pesticide products	100000 G	0.5	80	N/A	12
	Caustic Aqueous waste	Petroleum refining	173 T	0	99	0	12
	Caustic Aqueous waste	Petroleum refining	33 T	0	99	N/A	12
	Caustic Aqueous waste	Petroleum refining	10000 G	5	95	DK	12
	Caustic Aqueous waste	Photographic equipment and supplies	1610 G	0	90	N/A	12
	Caustic Aqueous waste	Plastics materials and resins, Adhesives and sealants	40 T	30	70	30	10
	Caustic Aqueous waste	Plating and polishing	4 T	3	95	0	12
	Caustic Aqueous waste	Plating and polishing	4908 G	14	86	7	12

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous Inorganic liquids (continued)	Acidic aqueous waste	Semiconductors and related devices	150000 T	1	99	0	7
	Acidic aqueous waste	Semiconductors and related devices	208 G	1	90	3	8
	Acidic aqueous waste	Soap and other detergents	1750 G	0	50	DK	12
	Acidic aqueous waste	Softwood veneer and plywood	3868620 G	0	99	0	2
	Acidic aqueous waste	Space propulsion units and parts	800000 G	0	100	0	2
	Acidic aqueous waste	Space research and technology	300 G	2	50	DK	2
	Acidic aqueous waste	Space research and technology	1 G	5	50	DK	2
	Acidic aqueous waste	Steel pipe and tubes	8000000 G	5	95	0	2
	Acidic aqueous waste	Steel wire and related products	25000 G	N/A	present	present	2
	Acidic aqueous waste	Storage batteries	70000 G	2	98	DK	3
	Acidic aqueous waste	Storage batteries, Primary batteries, dry and wet	118 T	0	DK	N/A	2
	Acidic aqueous waste	Surgical appliances and supplies	1318600 G	1	97	DK	7
	Acidic aqueous waste	Synthetic rubber	1200 T	0	99	0	2
	Acidic aqueous waste	Telephone and telegraph apparatus, Semiconductors and related devices,Radio and TV communication eq	480 G	15	85	0	4
	Acidic aqueous waste	Telephone and telegraph apparatus,Semiconductors and related devices	17000 G	1	DK	DK	2
	Acidic aqueous waste	Telephone and telegraph apparatus,Semiconductors and related devices	17000 G	1	DK	DK	2
	Acidic aqueous waste	Telephone and telegraph apparatus,Semiconductors and related devices	17000 G	1	DK	DK	2
	Acidic aqueous waste	Water supply	832058 T	0.1	95	0	12
Aqueous Inorganic liquids	Aqueous waste with low other toxic organics	Agricultural chemicals, nec	4096000 G	13	87	1	12
	Aqueous waste with low other toxic organics	Electrical equipment and supplies, nec	330 G	9	91	0	6
	Aqueous waste with low other toxic organics	Special warehousing and storage, nec	217000 G	15	85	2	3
Aqueous Inorganic liquids	Aqueous waste with low solvents	Cyclic crudes and intermediates	270000 G	10	85	5	4
	Aqueous waste with low solvents	Electrical equipment and supplies, nec	220 G	15	80	DK	11
	Aqueous waste with low solvents	General chemical manufacturing	1861 G	present	present	present	12
	Aqueous waste with low solvents	Pharmaceutical preparations	61 T	0	90	DK	7
	Aqueous waste with low solvents	Semiconductors and related devices	880 G	0	30	present	2
Aqueous Inorganic liquids	Caustic Aqueous waste	Agricultural chemicals, nec	3 T	1	91	3	10
	Caustic Aqueous waste	Agricultural chemicals, nec	436 T	1	0	N/A	10
	Caustic Aqueous waste	Agricultural chemicals, nec, Organic pesticide products	21 T	2	98	1	12
	Caustic Aqueous waste	Air, water, and solid waste management	100 G	0	90	0	12
	Caustic Aqueous waste	Aircraft engines and engine parts	220 G	DK	DK	DK	12
	Caustic Aqueous waste	Aircraft engines and engine parts	216 G	12	DK	DK	12
	Caustic Aqueous waste	Aircraft engines and engine parts	6832 G	DK	DK	DK	12
	Caustic Aqueous waste	Aircraft engines and engine parts	2280 G	DK	DK	DK	12
	Caustic Aqueous waste	Aircraft engines and engine parts	168 G	DK	DK	DK	12
	Caustic Aqueous waste	Aircraft engines and engine parts	1824 G	DK	DK	DK	12
	Caustic Aqueous waste	Aircraft engines and engine parts	12 G	DK	DK	DK	12
	Caustic Aqueous waste	Aircraft engines and engine parts	168 G	DK	DK	DK	12
	Caustic Aqueous waste	Aluminum sheet, plate, and foil, Aluminum rolling and drawing, nec	46000 T	1	99	DK	7
	Caustic Aqueous waste	Blast furnaces and steel mills	8 T	DK	DK	N/A	11
	Caustic Aqueous waste	Blast furnaces and steel mills	68 T	12	88	N/A	12
	Caustic Aqueous waste	Bolts, nuts, rivets, and washers	3840000 G	2	93	1	10
	Caustic Aqueous waste	Chemical preparations, nec	200 G	25	75	1	2
	Caustic Aqueous waste	Commercial laundry	13 T	40	60	0	2
	Caustic Aqueous waste	Costume jewelry	330 G	20	10	DK	12
	Caustic Aqueous waste	Costume jewelry	66 G	15	30	DK	12
	Caustic Aqueous waste	Cyclic crudes and intermediates	185000000 G	N/A	99	N/A	2
	Caustic Aqueous waste	DK	180 G	present	5	DK	11
	Caustic Aqueous waste	DK	DK	DK	DK	DK	12
	Caustic Aqueous waste	DK	5 G	0	50	0	12
	Caustic Aqueous waste	DK	18795 T	present	98	DK	12
	Caustic Aqueous waste	Electric services	3423000 G	DK	99	DK	2
	Caustic Aqueous waste	Electric services	4693 T	N/A	99	N/A	2
	Caustic Aqueous waste	Electric services	35997 T	DK	99	0	7.25
	Caustic Aqueous waste	Electric services	992715 G	present	99	DK	7.25
	Caustic Aqueous waste	Electric services	9602 T	0	99	N/A	7.25
	Caustic Aqueous waste	Electric services	1641 T	DK	99	N/A	7.25
	Caustic Aqueous waste	Electric services	1591 T	1	99	0	7.5
	Caustic Aqueous waste	Electric services	23852 T	DK	99	DK	7.5

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous inorganic liquids (continued)	Acidic aqueous waste	National security, Ammunition, except for small arms, nec	1100 G	0	90	N/A	2
	Acidic aqueous waste	Nitrogenous fertilizers	6580000 G	0	99	0	2
	Acidic aqueous waste	Nitrogenous fertilizers	70865200 G	2	98	DK	2
	Acidic aqueous waste	Nonferrous rolling and drawing, nec, Fabricated metal products, nec, Miscellaneous metal work	220 T	8	90	1	2
	Acidic aqueous waste	Nonferrous wire drawing and insulating	1578 G	6	98	N/A	2
	Acidic aqueous waste	Nonferrous wire drawing and insulating	29250 G	2	80	present	2
	Acidic aqueous waste	Nonmetallic mineral products, nec	1603440 G	2	98	DK	2
	Acidic aqueous waste	Nonwoven fabrics, Research and development laboratories	1 T	DK	DK	DK	2
	Acidic aqueous waste	Oil and gas field services, nec	180000 G	DK	DK	DK	7
	Acidic aqueous waste	Oil and gas field services, nec	72000 G	DK	DK	DK	7
	Acidic aqueous waste	Ordinance and accessories, nec	110 G	DK	90	N/A	2
	Acidic aqueous waste	Organic pesticide products	1387 T	5	99	0	2
	Acidic aqueous waste	Petroleum refining	8 T	25	75	DK	2
	Acidic aqueous waste	Petroleum refining	166327 G	DK	present	DK	6
	Acidic aqueous waste	Petroleum refining	468000 G	DK	present	DK	12
	Acidic aqueous waste	Phosphatic fertilizers	800 G	2	90	N/A	2
	Acidic aqueous waste	Photofinishing laboratories	12 G	10	90	0	2
	Acidic aqueous waste	Photofinishing laboratories, Signs and advertising displays,Photoengraving	85 G	DK	DK	DK	6
	Acidic aqueous waste	Photographic equipment and supplies	40 G	DK	DK	DK	2
	Acidic aqueous waste	Photographic equipment and supplies	1 T	N/A	90	0	2
	Acidic aqueous waste	Photographic equipment and supplies	1 T	N/A	60	30	2
	Acidic aqueous waste	Plastics materials and resins	10041 T	0	90	DK	2
	Acidic aqueous waste	Plating and polishing	DK	N/A	97	N/A	2
	Acidic aqueous waste	Plating and polishing	4900 G	15	90	N/A	2
	Acidic aqueous waste	Plating and polishing	495 G	DK	DK	DK	2
	Acidic aqueous waste	Plating and polishing	750 G	5	85	0	2
	Acidic aqueous waste	Plating and polishing	3500 G	2	87	0	2
	Acidic aqueous waste	Plating and polishing	150 G	5	98	0	2
	Acidic aqueous waste	Plating and polishing	2250000 G	N/A	99	DK	2
	Acidic aqueous waste	Plating and polishing	1123 T	0	99	DK	2
	Acidic aqueous waste	Plating and polishing	43875000 G	DK	99	DK	7
	Acidic aqueous waste	Plating and polishing, Current-carrying wiring devices, Electronic connectors	84000 T	1	99	DK	2
	Acidic aqueous waste	Plating and polishing,Metal coating and allied services	113333 G	DK	60	DK	2
	Acidic aqueous waste	Plating and polishing,Metal coating and allied services,Steel wire and related products	177270 T	present	93	N/A	2
	Acidic aqueous waste	Primary batteries, dry and wet	8 T	DK	DK	DK	2
	Acidic aqueous waste	Products of purchased glass	324 T	0	99	0	2
	Acidic aqueous waste	Radio and TV communication equipment	231 G	11	87	N/A	4
	Acidic aqueous waste	Radio and TV communication equipment,Electronic components, nec,Plating and polishing	490 T	18	N/A	N/A	2
	Acidic aqueous waste	Refrigeration and heating equipment, Motor vehicle parts and accessories,Aircraft equipment, nec	37200 G	1	99	DK	2
	Acidic aqueous waste	Refuse systems	450 G	N/A	40	N/A	4
	Acidic aqueous waste	Research and development laboratories	22 T	15	85	DK	2
	Acidic aqueous waste	Research and development laboratories	165 G	1	99	DK	2
	Acidic aqueous waste	Research and development laboratories	4428 G	DK	present	DK	3
	Acidic aqueous waste	Research and development laboratories	156 G	37	65	35	4
	Acidic aqueous waste	Secondary nonferrous metals, Aluminum rolling and drawing, nec, Nonferrous rolling and drawing, nec	17816 G	DK	98	DK	2
	Acidic aqueous waste	Semiconductors and related devices	8000000	1	98	1	2
	Acidic aqueous waste	Semiconductors and related devices	173600 G	0	80	0	2
	Acidic aqueous waste	Semiconductors and related devices	72650 G	0	70	0	2
	Acidic aqueous waste	Semiconductors and related devices	44500 G	0	19	0	2
	Acidic aqueous waste	Semiconductors and related devices	275 G	0	75	present	2
	Acidic aqueous waste	Semiconductors and related devices	250 G	0	60	0	2
	Acidic aqueous waste	Semiconductors and related devices	33900 G	14	79	0	2
	Acidic aqueous waste	Semiconductors and related devices	15310 G	present	99	N/A	2
	Acidic aqueous waste	Semiconductors and related devices	5 T	0	73	0	2
	Acidic aqueous waste	Semiconductors and related devices	44399027 G	present	99	present	2
	Acidic aqueous waste	Semiconductors and related devices	263500 T	1	98	1	3
	Acidic aqueous waste	Semiconductors and related devices	4 T	0	50	DK	3
	Acidic aqueous waste	Semiconductors and related devices	3444 T	3	94	0	4
	Acidic aqueous waste	Semiconductors and related devices	1 T	0	30	DK	4
	Acidic aqueous waste	Semiconductors and related devices	8 G	0	20	DK	4
	Acidic aqueous waste	Semiconductors and related devices	6837 T	1	51	present	6
	Acidic aqueous waste	Semiconductors and related devices	67510000 G	DK	DK	1	6.9

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous inorganic liquids (continued)	Acidic aqueous waste	Industrial inorganic chemicals, nec	5651 T	0.1	98	DK	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	3471 T	0	99	0	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	825000 G	2	98	1	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	5 G	1	99	DK	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	365000 T	1	95	0	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	3150000 G	present	90	0	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	365000000 G	DK	100	DK	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	935198 T	DK	95	0.1	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	148868 T	present	93	N/A	3
	Acidic aqueous waste	Industrial inorganic chemicals, nec	1217640 T	0	90	0	7
	Acidic aqueous waste	Industrial inorganic chemicals, nec	250000 G	N/A	90	N/A	7
	Acidic aqueous waste	Industrial inorganic chemicals, nec, Aircraft engines and engine parts	158 T	DK	95	0	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec, Nitrogenous fertilizers	2628000 G	0	95	not present	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec, Nitrogenous fertilizers	1578800 G	0	90	not present	2
	Acidic aqueous waste	Industrial organic chemicals, nec	118827 G	DK	95	DK	2
	Acidic aqueous waste	Industrial organic chemicals, nec	1017 T	0	97	0.1	2
	Acidic aqueous waste	Industrial organic chemicals, nec	2 T	present	present	present	2
	Acidic aqueous waste	Industrial organic chemicals, nec	126 T	present	present	present	2
	Acidic aqueous waste	Industrial organic chemicals, nec	DK	present	present	present	2
	Acidic aqueous waste	Industrial organic chemicals, nec	119 T	DK	90	DK	2
	Acidic aqueous waste	Industrial organic chemicals, nec	5100 G	5	90	N/A	2
	Acidic aqueous waste	Industrial organic chemicals, nec	2378150 G	0	98	0	2
	Acidic aqueous waste	Industrial organic chemicals, nec	489257 T	DK	95	0.8	2
	Acidic aqueous waste	Industrial organic chemicals, nec	280 G	DK	DK	0	2
	Acidic aqueous waste	Industrial organic chemicals, nec	1 T	DK	DK	DK	2
	Acidic aqueous waste	Industrial organic chemicals, nec	277778 T	DK	95	present	2
	Acidic aqueous waste	Industrial organic chemicals, nec	342 T	5	40	10	3
	Acidic aqueous waste	Industrial organic chemicals, nec	38 T	DK	70	DK	4
	Acidic aqueous waste	Industrial organic chemicals, nec	182382 T	1	98	1	4
	Acidic aqueous waste	Industrial organic chemicals, nec	404823 G	2	70	8	8
	Acidic aqueous waste	Industrial organic chemicals, nec	DK	present	present	0	8
	Acidic aqueous waste	Industrial organic chemicals, nec	6 T	2	98	0	7.5
	Acidic aqueous waste	Industrial organic chemicals, nec, Chemical preparations, nec	209 T	present	98	present	7.5
	Acidic aqueous waste	Industrial organic chemicals, nec, Industrial inorganic chemicals, nec	17302 T	DK	DK	DK	7.25
	Acidic aqueous waste	Industrial organic chemicals, nec,Industrial inorganic chemicals,nec, Nitrogenous fertilizers	64317 T	DK	98	present	2
	Acidic aqueous waste	Industrial organic chemicals, nec,Plastics materials and resins	26280000 G	0	99	not present	2
	Acidic aqueous waste	Industrial organic chemicals, nec,Plastics materials and resins	218900 T	present	99	present	2
	Acidic aqueous waste	Manufacturing industries, nec	78700 T	DK	96	present	9
	Acidic aqueous waste	Measuring and controlling devices, nec	1 G	1	40	6	4
	Acidic aqueous waste	Metal coating and allied services	557400 G	DK	present	DK	6
	Acidic aqueous waste	Metal coating and allied services	3852000 G	0.06	99	0	2
	Acidic aqueous waste	Metal coating and allied services, Fabricated structural metal, Architectural metal work	4500 T	2	98	0	10
	Acidic aqueous waste	Metal office furniture	747000 G	1	99	DK	2
	Acidic aqueous waste	Metal stampings, nec	2400 G	0	95	2	4
	Acidic aqueous waste	miscellaneous fabricated wire products	750000 G	1	99	1	2
	Acidic aqueous waste	miscellaneous fabricated wire products	13537 T	DK	90	DK	2
	Acidic aqueous waste	Miscellaneous plastics products	8144750 G	1	99	0	7
	Acidic aqueous waste	Miscellaneous plastics products	365422680 G	present	present	present	2
	Acidic aqueous waste	Miscellaneous plastics products	370 G	Dk	DK	DK	2
	Acidic aqueous waste	Motor vehicle parts and accessories	0 G	5	95	DK	4
	Acidic aqueous waste	Motorcycles, bicycles, and parts	2 T	98	2	DK	2
	Acidic aqueous waste	National security	2000 G	N/A	98	N/A	8
	Acidic aqueous waste	National security	DK	DK	present	DK	2
	Acidic aqueous waste	National security	1 T	DK	DK	DK	2
	Acidic aqueous waste	National security	1 T	DK	DK	DK	2
	Acidic aqueous waste	National security	14700000 G	present	99	present	2
	Acidic aqueous waste	National security	19 G	0	43	0	2
	Acidic aqueous waste	National security	1 G	0	75	0	2
	Acidic aqueous waste	National security	2 G	0	4	0	2
	Acidic aqueous waste	National security	20 G	0	50	0	2
	Acidic aqueous waste	National security	1 T	0	50	DK	4
	Acidic aqueous waste	National security	700000 G	1	99	0	8

Table C-1 (continued)

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous inorganic liquids (continued)	Acidic aqueous waste	Electric and other services combined, Electric services	4125 T	1	99	1	2
	Acidic aqueous waste	Electric services	1534068 G	DK	DK	DK	2
	Acidic aqueous waste	Electric services	41000 G	present	99	N/A	2
	Acidic aqueous waste	Electric services	48542 T	N/A	99	N/A	2
	Acidic aqueous waste	Electric services	DK	1	present	DK	2
	Acidic aqueous waste	Electric services	172621 T	1	99	0	2
	Acidic aqueous waste	Electric services	238032 T	1	99	0	2
	Acidic aqueous waste	Electric services	1447 T	N/A	95	N/A	2
	Acidic aqueous waste	Electric services	9293 T	N/A	95	N/A	2
	Acidic aqueous waste	Electric services	809 T	N/A	95	N/A	2
	Acidic aqueous waste	Electric services	8320300 G	N/A	present	N/A	2
	Acidic aqueous waste	Electric services	818000 G	N/A	present	N/A	2
	Acidic aqueous waste	Electric services	943000 G	N/A	present	N/A	2
	Acidic aqueous waste	Electric services	273100 G	N/A	present	N/A	2
	Acidic aqueous waste	Electric services	3711800 G	N/A	present	N/A	2
	Acidic aqueous waste	Electric services	282800 G	N/A	present	N/A	2
	Acidic aqueous waste	Electric services	218 G	present	DK	N/A	2
	Acidic aqueous waste	Electric services	1648800 G	N/A	present	N/A	2
	Acidic aqueous waste	Electric services	413335 G	DK	99	DK	7
	Acidic aqueous waste	Electric services	6687400 G	DK	DK	DK	7
	Acidic aqueous waste	Electric services	3753634 G	DK	DK	DK	7
	Acidic aqueous waste	Electric services	189200 G	DK	DK	DK	7
	Acidic aqueous waste	Electric services	130720 G	DK	DK	DK	7
	Acidic aqueous waste	Electric services	9233 T	DK	99	DK	7.25
	Acidic aqueous waste	Electron tubes, transmitting	1201368 G	present	99	DK	6
	Acidic aqueous waste	Electronic capacitors	5 T	DK	30	1	2
	Acidic aqueous waste	Electronic components, nec	259 G	DK	DK	DK	2
	Acidic aqueous waste	Electronic components, nec	338 G	DK	DK	DK	2
	Acidic aqueous waste	Electronic components, nec	300 G	1	93	DK	2
	Acidic aqueous waste	Electronic components, nec	50 G	1	DK	DK	2
	Acidic aqueous waste	Electronic components, nec	3 T	DK	DK	DK	5
	Acidic aqueous waste	Electronic components, nec	16797000 G	present	95	present	7
	Acidic aqueous waste	Electronic components, nec	1500 G	0	99	0	8
	Acidic aqueous waste	Electronic computing equipment	1260 G	1	90	DK	2
	Acidic aqueous waste	Electronic computing equipment,Electronic components, nec	1 T	7	90	0	2
	Acidic aqueous waste	Electronic computing equipment,Electronic components, nec	1 T	1	50	0	2
	Acidic aqueous waste	Electronic computing equipment,Electronic components, nec	1 T	1	30	0	2
	Acidic aqueous waste	Electronic computing equipment,Electronic components, nec	2127 T	0	99	DK	2
	Acidic aqueous waste	Engine electrical equipment	39 T	DK	DK	DK	2
	Acidic aqueous waste	Engine electrical equipment	2400 G	0	98	0	6
	Acidic aqueous waste	Engineering and scientific instruments, Environmental controls, Process control instruments	32620 G	present	80	0	2
	Acidic aqueous waste	Engineering and scientific instruments, Surgical and medical instruments	176 G	present	99	DK	2
	Acidic aqueous waste	Engraving and plate printing	1870 G	present	20	DK	2
	Acidic aqueous waste	Fabricated metal products, nec, Plating and polishing	2703279 G	DK	95	N/A	2
	Acidic aqueous waste	General chemical manufacturing	350 T	0.5	98	0.2	2
	Acidic aqueous waste	General chemical manufacturing	300000 G	0	99	DK	7
	Acidic aqueous waste	General chemical manufacturing, Industrial organic chemicals, nec,Petroleum refining	703 T	DK	90	DK	6
	Acidic aqueous waste	General crop services	2854 T	1	99	DK	2
	Acidic aqueous waste	General crop services	4 G	DK	present	N/A	2
	Acidic aqueous waste	Glass containers	211237 G	22	78	N/A	2.3
	Acidic aqueous waste	Guided missiles and space vehicles, Space propulsion units and parts	2 T	DK	90	N/A	2
	Acidic aqueous waste	Guided missiles and space vehicles, Space propulsion units and parts	1 T	5	99	N/A	6
	Acidic aqueous waste	Hand and edge tools, nec	1 T	N/A	N/A	N/A	2
	Acidic aqueous waste	Household cooking equipment,Household appliances, nec	10800000 G	N/A	98	0	2
	Acidic aqueous waste	Industrial gases	44876000 G	10	99	1	3
	Acidic aqueous waste	Industrial inorganic and organic chemicals, nec, Nitrogenous fertilizers	DK	present	present	N/A	2
	Acidic aqueous waste	Industrial inorganic and organic chemicals, nec, Nitrogenous fertilizers	DK	present	present	N/A	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	4400000 T	present	present	N/A	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	78118501 G	1	99	0	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	1005 G	1	97	N/A	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	41300 G	0	99	0	2
	Acidic aqueous waste	Industrial inorganic chemicals, nec	49000 G	0	99	0	2

Table C-1 Characterization Data for Characteristic Corrosive Wastes D002

PHYSICAL WASTE DESCRIPTION	WASTE DESCRIPTION	INDUSTRIAL DESCRIPTION	QUANTITY	SOLIDS (%)	WATER (%)	ORGANIC CONTENT (%)	PH
Aqueous inorganic liquids	Acidic aqueous waste	Abrasive products	110 G	DK	DK	DK	2
	Acidic aqueous waste	Agricultural chemicals, nec	8 T	N/A	83	N/A	2
	Acidic aqueous waste	Agricultural chemicals, nec	9620 T	1	99	DK	2
	Acidic aqueous waste	Agricultural chemicals, nec	836 T	0	90	0	2
	Acidic aqueous waste	Agricultural chemicals, nec, Organic pesticide products	22 T	1	99	DK	2
	Acidic aqueous waste	Aircraft	322 G	0	DK	0	2
	Acidic aqueous waste	Aircraft engines and engine parts	48 G	2	DK	DK	2
	Acidic aqueous waste	Aircraft engines and engine parts	8048 G	DK	DK	DK	2
	Acidic aqueous waste	Aircraft engines and engine parts	4848 G	DK	DK	DK	2
	Acidic aqueous waste	Aircraft equipment, nec	800 G	1	DK	DK	2
	Acidic aqueous waste	Aircraft equipment, nec	276 G	73	DK	DK	2
	Acidic aqueous waste	Aircraft equipment, nec	1000 G	6	78	DK	2.8
	Acidic aqueous waste	Aircraft equipment, nec	1430 G	2	DK	DK	4
	Acidic aqueous waste	Aircraft equipment, nec	1000 G	6	78	DK	6
	Acidic aqueous waste	Alkalies and chlorine	88088 G	1	95	N/A	2
	Acidic aqueous waste	Alkalies and chlorine	2628000 G	DK	DK	DK	2
	Acidic aqueous waste	Animal specialties, nec	180 G	0	99	present	2
	Acidic aqueous waste	Blast furnaces and steel mills	DK	N/A	DK	DK	2
	Acidic aqueous waste	Blast furnaces and steel mills	700000 T	6	99	DK	2
	Acidic aqueous waste	Bolts, nuts, rivets, and washers	130000 G	2	93	1	6
	Acidic aqueous waste	Building maintenance services, nec	1 T	85	DK	DK	2.8
	Acidic aqueous waste	Chemical preparations, nec	28000 T	DK	99	DK	2
	Acidic aqueous waste	Chemical preparations, nec	8074 T	DK	DK	DK	2
	Acidic aqueous waste	Chemicals and allied products	12000 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products	15000 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products	8 T	1	80	0	2
	Acidic aqueous waste	Chemicals and allied products, Industrial inorganic chemicals, nec, Industrial organic chemicals, nec	15578 G	DK	DK	0	6
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	3400 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	10000 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	8400 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	78000 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	20800 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	1200 G	DK	99	DK	2
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	0	DK	99	N/A	7
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	18000 G	DK	99	DK	7
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	8000 G	DK	99	0	7
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	700 G	DK	99	DK	7
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	40782 G	DK	99	DK	7
	Acidic aqueous waste	Chemicals and allied products, Petroleum products, nec	10200 G	DK	99	DK	7
	Acidic aqueous waste	Cold finishing of steel shapes	4000000 G	1	99	DK	2.3
	Acidic aqueous waste	Colleges and universities, nec	2 T	3	10	0	2
	Acidic aqueous waste	Commercial testing laboratories	15 T	DK	DK	DK	3
	Acidic aqueous waste	Copper rolling and drawing	375000 T	1	99	0	2
	Acidic aqueous waste	Copper rolling and drawing, Brass, bronze, and copper foundries, Nonferrous forgings	337100 T	DK	99	DK	3
	Acidic aqueous waste	Copper rolling and drawing, Motor vehicle parts and accessories	124327 T	DK	DK	N/A	2
	Acidic aqueous waste	Costume jewelry, General chemical manufacturing, Chemical preparations, nec	11 T	0	80	DK	2
	Acidic aqueous waste	Costume jewelry, General chemical manufacturing, Chemical preparations, nec	1 T	0	DK	N/A	2
	Acidic aqueous waste	Costume jewelry, General chemical manufacturing, Chemical preparations, nec	18 T	0	58	DK	12
	Acidic aqueous waste	Current-carrying wiring devices,Electron tubes, transmitting,Electronic components, nec	2250 G	1	97	1	3
	Acidic aqueous waste	Current-carrying wiring devices,Electron tubes, transmitting,Electronic components, nec	2700 G	1	97	1	3
	Acidic aqueous waste	Cyclic crudes and intermediates	48430 T	0	98	0	2
	Acidic aqueous waste	Cyclic crudes and intermediates	6915 T	0	84	18	2
	Acidic aqueous waste	Cyclic crudes and intermediates	13000 T	0	99	0	2
	Acidic aqueous waste	Cyclic crudes and intermediates, Nitrogenous fertilizers	14800 T	DK	98	DK	2
	Acidic aqueous waste	Cyclic crudes and intermediates, Surface active agents	0	DK	90	1	4
	Acidic aqueous waste	DK	46800 G	0	99	0	2
	Acidic aqueous waste	DK	8000000 G	DK	99	DK	2
	Acidic aqueous waste	DK	83072000 G	0	99	not present	2
	Acidic aqueous waste	DK	41527 T	present	94	DK	2
	Acidic aqueous waste	DK	67600 G	DK	98	DK	7
	Acidic aqueous waste	DK	131600 G	DK	99	DK	7
	Acidic aqueous waste	Electric and other services combined	50 G	0	95	DK	2

APPENDIX C

WASTE CHARACTERIZATION AND INDUSTRIAL DESCRIPTIONS FOR D002 WASTES

ANALYTE: Flashpoint

Date: 03-02-90
Versar Job #: 5254.15.2

Compound	Amount of Compound in 100 mL DI	Flashpoint (°F)	Comments
acetone	2.0 mL	135.	flame extinguished
carbon disulfide	0.30 mL	>200.	green flame at 185 °F
ethyl acetate	2.0 mL	80.	flame extinguished
ethyl ether	2.2 mL	**	
methylethyl ketone	1.9 mL	175.	supports combustion
methylisobutyl ketone	1.7 mL	80.	flame extinguished
pyridine	1.3 mL	191.	flame was extinguished at 142 °F
tetrahydrofuran	1.7 mL	100.	flame extinguished

** = At 115 °F, and at every 5 degree interval thereafter, the size of the test flame increased substantially. However, no true flashes were observed.

Versar INC

MEMORANDUM

TO: Ken Ives

FROM: Chris Thompson

DATE: March 27, 1990

SUBJ: Project 5254.15.2 Flashpoint Analysis

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1. Attached is a copy of the flashpoint results for the solvent solutions.

2. The samples were prepared on February 23, 1990. The solvents were mixed with deionized water until a saturated solution was obtained. The volume of solvent soluble in 100 mls of water is listed on the data page. This solution was tested for flashpoint on February 27 and 28 using a Pensky-Marten closed-cup tester.

3. If you have any questions concerning the preparation or testing of the solutions, don't hesitate to call.

cc: Jim Berkes

APPENDIX B

D001 IGNITABLE LIQUIDS WASTEWATERS FLASHPOINT ANALYSES

Table A-4 Waste Characterization Data for D001 Oxidizer Subcategory

Type of waste	Constituents	General or typical concentration or amount	Comments
Propellants, exploding and pyrotechnics	Potassium Nitrate	Trace	D001
	Barium Peroxide	Trace	D001, D005,
	Strontium Nitrate	Trace	D001
	Potassium Chlorate	Trace	D001
Waste Propellant	Barium Nitrate	Trace	D001, D005,
	Potassium Nitrate	Trace	D001

Reference: Department of the Army 1987.

Table A-3 Available Waste Characterizaton Data for D001 Ignitable Liquids Subcategory

Waste constituent	Total concentration (%)	
	Low	High
Volatile Organics		
1,1,1 Trichloroethane	10	25
1,1,2,2 Tetrachloroethane	5	10
1,2 Dichloroethane	5	10
(1,3 Butandiol)	5	10
(2 Pentanol)	5	10
(2 Propanol)	10	20
(2-Ethoxy Ethanol)	5	10
Acetone	11	20
Acetonitrile	20	35
Benzene	3	5
Carbon Disulfide	0	5
Carbon Tetrachloride	5	10
Chloroform	4.25	8.50
Cyclohexane	7.50	15
Ethanol	0.75	14.75
Ether	15	20
Ethyl Ether	0	40
Ethyl Acetate	8.75	15.25
(Ethyl Alcohol)	24.17	32
Ethyl Benzene	0	8
Ethylene Glycol	6	12
Ethylene Vinyl Acetate	5	15
(Heptane)	20	40
(Hexane)	6.25	12.75
Isobutyl Alcohol	0	21
Isopropanol	6	10
Methanol	15	29.40
Methylene Chloride	2.50	14.00
Methyl Ethyl Ketone	18.22	25.63
Methyl Isobutyl Ketone	0	2.82
Methylamine	0	37
(Pentanol)	3	5
Perchloroethylene	5	10
Petroleum Ether	10	20
Styrene	0	95
Toluene	6	15
Trichloroethylene	12.50	17.50
Trichlorotrifluoroethane	2	7
Xylene	17./86	32.61
Volatile organics not specified	28.44	44.79

Note: ( ) denotes a non-BDAT constituent.

Reference: Robertson 1989.

Table A-2 (continued)

SIC code	Industry description	Waste code	Waste description	Amount generated in tons	Management practice in 1986
2869	Industrial organic chemicals (cont.)	D001	Aqueous waste with low solvents	383	Surface impoundment
		D002	Acidic aqueous waste		
3662	Mining and quarries of non-metallic minerals, except fuel	D001	Aqueous waste with other reactives (e.g., explosives)	8,382	Surface impoundment
	Other primary metals industries	D007	Other metal salts/chemicals		
	Textile mill products	U188	Concentrated phenolics		
3699	Other electrical and electronic machinery, equipment, and supplies industries	D001	Acidic aqueous waste	507,128	Surface impoundment
		D002	Caustic aqueous waste		
2839	Pharmaceutical preparations	D001	Aqueous waste	54,167	Underground injection
		D007			
		F002			
		F003			
		F005			

Reference: USEPA 1986a.

Table A-2 (continued)

SIC code	Industry description	Waste code	Waste description	Amount generated in tons	Management practice in 1986
2869	Industrial organic chemicals (cont.)	D001	"Dry" line or metal hydroxide solids not "fixed"	2	Surface impoundment
		D002	Batteries or battery parts, casings, cores		
		D001	Aqueous waste with low solvents	40,725	Surface impoundment
		D002	Acidic aqueous waste		
		D003	Aqueous waste with reactive sulfides		
		D007	Other inorganic liquid		
		D001	Aqueous waste with low other toxic organics	7,425	Surface impoundment
		D002	Acidic aqueous waste		
		K011	Aqueous waste with low other toxic organics		
		K013	Aqueous waste with low other toxic organics		
		K014	Aqueous waste with low other toxic organics		
		D001	Reactive or polymerizable organic liquid	899	Surface impoundment
		D002			
		D003			
		F003	Nonhalogenated solvent		
		D001	Nonhalogenated solvent	176	Surface impoundment
		D002			
		D001	Nonhalogenated solvent	37	Surface impoundment
		D002	Reactive or polymerizable organic liquid		
		D003			

Table A-2 (continued)

SIC code	Industry description	Waste code	Waste description	Amount generated in tons	Management practice in 1986
2821	Plastics materials, synthetic resins, and non-volcanizable elastomers	D001	Acidic aqueous waste	1,352	Surface Impoundment
		D002	Other reactive chemicals		
		D003			
2833	Medicinal chemicals and botanical products	D001	Concentrated solvent-water solution	2,458,353	Surface Impoundment
		D002	Acidic aqueous waste		
		D002	Caustic aqueous waste		
		D003	Caustic solution with cyanides but no metals		
		F002	Aqueous waste with low solvents		
		F003	Aqueous waste with low solvents		
		P106	Caustic solution with cyanides but no metals		
		U080	Halogenated (e.g., chlorinated) solvent		
		U112	Nonhalogenated solvent		
		U154	Nonhalogenated solvent		
		U220	Nonhalogenated solvent		
2869	Industrial organic chemicals	D001	Reactive or polymerizable organic liquid	65,753	Surface Impoundment
		D002			
		D003			
		D001	Reactive or polymerizable organic liquid	19	Surface Impoundment
		D003			
		D001	Waste oil	30	Surface Impoundment
		D002			
		D007			

Table A-2 (continued)

SIC code	Industry description	Waste code	Waste description	Amount generated in tons	Management practice in 1986
8221	Colleges, universities, professional schools, and junior colleges	D001 D002 D003 U075 U151	Lab packs of old chemicals only	5	Landfill
2800	Chemicals and chemical preparations	D001 D009	Lab packs of old chemicals only	1	Landfill
		D001 D009 D003	Lab packs of debris only	1	Landfill
		D001 D009 D011	Other metal salts/chemicals only	3	Landfill
9711	National security	D001 F003 F005	Nonhalogenated solvent	1	Landfill
		D001 D007	Other waste inorganic chemicals	50	Landfill
1321	Oil and gas extraction	D001 D003	Spent solid filters or absorbents	61	Landfill

Table A-2 Characterization and Industry Data for Mixed Wastes Containing Ignitable (D001) Wastes According to the 1986 TSDR Survey for Non-CBI, Non-commercial Facilities Only

SIC code	Industry description	Waste code	Waste description	Amount generated in tons	Management practice in 1986
2911	Petroleum refining	D001 D003 D007 D008	Oily sludge	11	Land treatment
		D001 D003	Oily sludge	538	Land treatment
		D001 D007 D008	Soil contaminated with organics	7	Land treatment
		D001 D002	"Dry" line or metal hydroxide solids not "fixed"	4	Land treatment
		D001 D002 D003	Reactive sulfide salts/chemicals	7	Land treatment
		D001 K051	Concentrated aqueous solution of other organic	239	Surface impoundment
		D001 D002 D003	Concentrated aqueous solution of other organic	239	Surface impoundment

Table A-1 (continued)

SIC code	Industry description	Waste description	Amount generated in tons	Management practice in 1986
8999	Commercial Treatment, Storage, Disposal Facility (continued)	Other aqueous wastes with low dissolved solids	402	Underground injection
		Aqueous waste with other low toxic organics	1,424	Underground injection
		Halogenated/nonhalogenated solvent mixture generated by the manufacturers of other miscellaneous plastic products industry	978	Waste piles
		Aqueous solution with low solvents generated from the production of motor vehicle parts and accessories	11,505	Waste piles

Reference: USEPA 1986a.

Table A-1 (continued)

SIC code	Industry description	Waste description	Amount generated in tons	Management practice in 1986
8999	Commercial Treatment, Storage, Disposal Facility (continued)	Spent acid with metals	1	Landfill
		Spent acid without metals	1	Landfill
		Other inorganic sludge	56	Landfill
		Caustic aqueous waste	1	Landfill
		Aqueous waste with reactive sulfides	1	Landfill
		Aqueous waste with low solvent	1,993	Landfill
		Other organic liquid, NOS	3,449	Surface impoundment
		Equipment cleaning effluent	2	Surface impoundment
		Spent acid with metals	21	Surface impoundment
		Caustic solution with metals but no cyanides	5	Surface impoundment
		Halogenated/nonhalogenated solvent mixture	13,125	Underground injection
		Contact flash point less than 140°F generated by the industrial organic chemicals industry	4,167	Underground injection
		Concentrated solvent-water solution generated by the manufacturers of paints, varnishes, lacquers, enamels, and allied products	4,167	Underground injection
		Other organic liquid	3,340	Underground injection
		Oil-water emulsion or mixture	1,683	Underground injection
		Paint thinner or petroleum distillates	121	Underground injection
		Nonhalogenated solvent	54	Underground injection
		Aqueous waste with other low toxic organics generated by the industrial organic chemicals industry	1,718	Underground injection

Table A-1 (continued)

SIC code	Industry description	Waste description	Amount generated in tons	Management practice in 1986
8999	Commercial Treatment, Storage, Disposal Facility	Empty or crushed metal drums or containers generated by the semiconductors and related devices industry	919	Landfill
		Lab packs of solid old organic chemicals, only	315	Landfill
		Empty or crushed metal drums or containers	57	Landfill
		Solid resins or polymerized organics generated by the manufacturers of paints, varnishes, lacquers, enamels, and allied products	8,687	Landfill
		Other nonhalogenated organic solids	850	Landfill
		Adhesives or expoxies	5	Landfill
		Organic paint or ink sludge	401	Landfill
		Other organic sludge, NOS	433	Landfill
		Resins, tars, or tarry sludge	94	Landfill
		Other organic sludge	48	Landfill
		Still bottoms of nonhalogenated solvents or other organic liquids	26	Landfill
		Halogenated/nonhalogenated solvent mixture	107	Landfill
		Other organic liquid	253	Landfill
		Waste oil	25	Landfill
		Halogenated (e.g., chlorinated) solvent	18	Landfill
		Reactive or polymerizable organic liquid	5	Landfill
		Soil contaminated with organics	810	Landfill
		Ash, slag, or other residue from incineration of wastes	4,598	Landfill
		Other inorganic solids	91	Landfill
		Other inorganic solids, NOS generated by the chemicals and chemical preparations industry,	54 11	Landfill
		Asbestos solids and debris	3	Landfill
		Metal scale, filings, or scrap	1	Landfill
		Other inorganic solids	1	Landfill
		Drilling mud	2	Landfill
		Caustic solution with metals but no cyanides	4	Landfill
		Other inorganic liquid	2	Landfill

Table A-1 (continued)

SIC code	Industry description	Waste description	Amount generated in tons	Management practice in 1986
2869	Industrial organic chemicals (cont.)	Solid resins or polymerized organics	172	Landfill
		Solid resins or polymerized organics	1	Landfill
		Metal scale, filings, or scrap	1	Landfill
		Solid resins or polymerized organics	83	Landfill
		Solid resins or polymerized organics	9	Landfill
		Spent solid filters or a desorbent	21	Landfill
		Nonhalogenated solvent	45	Surface impoundment
		Nonhalogenated solvent	28,883	Surface impoundment
		Nonhalogenated solvent	322	Surface impoundment
		Waste oil	383,333	Surface impoundment
		Concentrated aqueous solution of other organics	4,695	Surface impoundment
		Nonhalogenated solvent	4	Surface impoundment
		Soil contaminated with organics	329	Surface impoundment
		Sediment or lagoon dragout contaminated with organics only	303	Surface impoundment
		Sludge with other reactives	31	Surface impoundment
		Acidic aqueous waste	462	Underground injection
2879	Pesticides and agricultural chemicals	Lab packs of old chemicals only	15	Landfill
3317	Coating engraving and allied services	Solid resins or polymerized organics	35	Landfill
2819	Other	Organic paint or ink sludge	19,285	Waste piles
3546	Other fabricated metal products industries, except machinery and transportation equipment industries	Metal scale, filings, or scrap	10	Surface impoundment
3674	Semiconductors and related devices	Concentrated aqueous solution of other organics	45	Surface impoundment
3674	Semiconductors and related devices	Other organic liquid, WOS	1	Surface impoundment
4911	Other electronic, gas, and sanitary services industries	Oil-water emulsion or mixture	42	Surface impoundment
3711	Motor vehicles and passenger car bodies	Empty or crushed metal drums or containers	1	Waste piles
		Solid resins or polymerized organics	3	Waste piles
		Spent solid filters or adsorbents	2	Waste piles
9711	National security	Nonhalogenated solvent	1	Landfill
9711	National security	Other inorganic solids	2	Landfill

Table A-1 Characterization and Industry Data for D001 Wastes That Are Only Characteristic Ignitable Wastes (i.e., not mixed with other hazardous wastes) According to the 1986 TSDR Survey for Non-CBI Facilities Only

SIC code	Industry description	Waste description	Amount generated in tons	Management practice in 1986
2911	Petroleum refining	Other organic sludge	28	Land treatment
		Oily sludge	3	Land treatment
		Oily sludge	1	Land treatment
		Oily sludge	2,030	Land treatment
		Oily sludge	310	Land treatment
		Oily sludge	281	Land treatment
		Oily sludge	73	Land treatment
		Oil-water emulsion or mixture	142	Land treatment
		Soil contaminated with organics	2,703	Land treatment
		Soil contaminated with organics	204	Land treatment
		Soil contaminated with organics	1	Land treatment
		Other inorganic solids	43	Land treatment
		Spent solid filters or absorbents	80	Land treatment
		Spent solid filters or absorbents	13	Land treatment
		Spent solid filters or absorbents	7	Land treatment
		Metal scale, filings, or scrap	1	Land treatment
		Other inorganic sludge	182	Land treatment
		Other organic sludge	12	Landfill
		Spent carbon	39	Landfill
		Oily sludge	208	Surface impoundment
		Soil contaminated with organics	297	Surface impoundment
		Other inorganic chemicals	1	Surface impoundment
		Spent carbon	12	Waste piles
		Soil contaminated with organics	19	Landfill
3011	Miscellaneous plastics products	Oil-water emulsion or mixture	754	Land treatment
8221	Colleges, universities, professional schools	Other organic liquid	15	Landfill
2800	Chemicals and chemical preparations	Other waste inorganic chemicals	6	Landfill
2821	Plastics materials, synthetic resins, nonvolcanizable elastomers	Spent solid filters or absorbents	3,140	Landfill
		Other organic liquid	29	Landfill
2869	Industrial organic chemicals	Mixed lab packs	15	Landfill
		Other nonhalogenated organic solid	41	Landfill

APPENDIX A

WASTE CHARACTERIZATION AND INDUSTRIAL DESCRIPTIONS FOR D001 WASTES

USEPA. 1989c. U.S. Environmental Protection Agency, Office of Solid Waste. Computer printout: data on treatment of D001, D002, and D003 wastes from the 1986 Treatment, Storage, Disposal, and Recycling Survey data base. Retrieved October 27, 1989. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989d. U.S. Environmental Protection Agency, Office of Solid Waste. Computer printout: data on treatment of D001, D002, and D003 wastes from the 1986 Generator Survey data base. Retrieved October 27, 1989. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989e. U.S. Environmental Protection Agency, Office of Solid Waste. Best demonstrated available technology (BDAT) background document for wastewaters containing BDAT list constituents. Washington, DC: U.S. Environmental Protection Agency.

Weast, R.C., ed. 1980. CRC handbook of chemistry and physics. 61st ed. p. C-134. Boca Raton, Fla.: CRC Press, Inc.

Wilk, Palmer, and Breton. 1988. U.S. Environmental Protection Agency. Technical resource document: Treatment technologies for corrosive-containing wastes, Vol. II. Cincinnati, Ohio: U.S. Environmental Protection Agency.

Yoder, M., DPRA. 1989. Letter to Laura L. Fargo, Versar Inc. concerning 1986 TSDR printout for units/systems with specified unit types.

Winams and Dreier. 1980. Innovative acid pickling waste treatment at Universal-Cyclops stainless steel plant. As presented in the Proceedings of the Purdue Industrial Waste Conference. Ann Arbor, Mich.: Ann Arbor Science Publishers Inc.

Windholz, M., ed. 1983. The Merck index. 10th ed. Rahway, N.J.: Merck and Company.

USEPA. 1988b. U.S. Environmental Protection Agency. Best demonstrated available technology background document for cyanide wastes. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988c. U.S. Environmental Protection Agency. Project summary on technical resource document: treatment technologies for corrosive-containing wastes, Vol. II. Cincinnati, Ohio: U.S. Environmental Protection Agency.

USEPA. 1988d. U.S. Environmental Protection Agency. Project summary on technical resource document: treatment technologies for halogenated organic-containing wastes, Vol. I. Cincinnati, Ohio: U.S. Environmental Protection Agency.

USEPA. 1988e. U.S. Environmental Protection Agency, Office of Solid Waste. Computer printout: Data for D001, D002, D003, and P and U wastes containing reactive listing constituents from the Generator Survey data base. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988f. U.S. Environmental Protection Agency, Office of Solid Waste. Computer printout: data on wastewater treatment processes for specific treatment of fluoride wastes from the 1986 TSDR Survey. Retrieved September 26, 1988. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988g. U.S. Environmental Protection Agency. Best demonstrated available technology (BDAT) background document for F006 wastes. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1988h. U.S. Environmental Protection Agency. Best demonstrated available technology (BDAT) background document for K062 wastes. Washington, DC: U.S. Environmental Protection Agency.

USEPA. 1988i. U.S. Environmental Protection Agency. Onsite engineering report of treatment technology and performance for K061 waste at Horsehead Resource Development Company, Inc. Palmerton, Pennsylvania. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989a. U.S. Environmental Protection Agency. Treatment technologies background document. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1989b. U.S. Environmental Protection Agency, Office of Solid Waste. Computer printout: data on processes for specific treatment of waste oxidizers from the 1986 TSDR Survey. Retrieved August 2, 1989. Washington, D.C.: U.S. Environmental Protection Agency.

Turkeltaub and Wiehl. 1989. Cleaning up explosives contamination at Army munitions plants using incineration. Hazardous Materials Control 2(4), July-August 1989.

USEPA. 1983a. U.S. Environmental Protection Agency. Methods for chemical analysis of waters and wastes. EPA-600/4-79-020. Cincinnati, Ohio: Environmental Monitoring and Support Laboratory.

USEPA. 1983b. U.S. Environmental Protrection Agency. Development document for effluent limitations guidelines and standards for the metal finishing point source category. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1985. U.S. Environmental Protection Agency. Case studies of existing treatment applied to hazardous waste banned from landfills-waste category assessment report corrosive waste. Prepared by GCA Corporation. Cincinnati, Ohio: U.S. Environmental Protection Agency.

USEPA. 1986a. U.S. Environmental Protection Agency. National survey of hazardous waste treatment, storage, disposal, and recycling facilities. Computer printout: data on non-CBI commercial facilities only sorted by management category.

USEPA. 1986c. U.S. Environmental Protection Agency. Onsite engineering report of treatment technology performance and operation for Envirite Corporation, York, Pennsylvania. Washington, DC: U.S. Environmental Protection Agency.

USEPA. 1986b. U.S. Environmental Protection Agency. Test methods for evaluating solid waste, SW-846 3rd ed. Office of Solid Waste and Emergency Response. Washington, D.C.: U.S. Environmental Protection Agency.

USEPA. 1987a. U.S. Environmental Protection Agency. Generic quality assurance project plan for land disposal restrictions program (BDAT). EPA/530-SW-87-011. Washington, D.C.: U.S. Environmental Protection Agency, Office of Solid Waste.

USEPA. 1987b. U.S. Environmental Protection Agency. Project summary on technical resource document: treatment technologies for solvent-containing wastes. Cincinnati, Ohio: U.S. Environmental Protection Agency.

USEPA. 1988a. U.S. Environmental Protection Agency. Methodology for developing BDAT treatment standards. Washington, D.C.: U.S. Environmental Protection Agency.

Giusti, Conway, and Lawson. 1974. Activated carbon adsorption of petrochemicals. WPCF 46(5).

Hammond. 1986. The Dow Stretford chemical recovery process. Environmental Progress 5(1).

Hunt, L.F. and Sanow, D.J. 1989. Certification of solidified zirconium fines for disposal at the RWMC. Prepared for the U.S. Department of Energy by EG&G Idaho, Inc. Idaho Falls, Idaho.

Hutton, D.G. 1981. Removal of priority pollutants with a combined powdered activated carbon - activated sludge process. Vol. 2. In Chemistry in water reuse ed. W. R. Cooper, pp. 403-428. Ann Arbor Mich.: Ann Arbor Science.

Kirk-Othmer. 1979. Encyclopedia of chemical technology, 2nd ed. New York: John Wiley and Sons.

McGlathery, M., Exxon Chemicals. 1989. Data Package to the Superfund Technology Demonstration Division concerning a site proposal.

American Society for Metals. 1984. Metals handbook, 9th ed., Vol. 7. Metals Park, Ohio: American Society for Metals.

Morrison, R., and Boyd, R., 1983. Organic chemistry. 4th ed. Newton, Massachusetts: Allyn and Bacon, Inc.

NASA. 1989. National Aeronautics and Space Administration. Pilot plant study of MMH neutralization by ozonation. (Draft report). Las Cruces, New Mex.:, Johnson Space Center.

Olexsey, Blaney, Turner, and Brown. 1988. Technologies for the recovery of solvents from hazardous wastes. Hazardous Waste and Hazardous Materials, 5(4).

Rissmann, E., and Fargo, L., Versar. 1989. Letter to Juan Baez-Martinez, EPA, concerning phone calls made to generators/treators of reactive wastes.

Robertson, T., Ross Environmental Services, Inc. 1989. To Jim Berlow, EPA comment concerning EPA's approach to remaining wastes.

Sax, N. Irving, and Richard J. Lewis, Sr. 1987. Dangerous properties of industrial materials. 7th ed.

Sobororoff, Troyer, and Cochran. 1978. A one-step method for recycling waste chromic acid-sulfuric acid etching solutions. As presented in the Proceedings of the Purdue Industrial Waste Conference. Ann Arbor, Mich.: Ann Arbor Science Publishers Inc.

6. REFERENCES

Alchowiak, J. and Truskett, O. 1989. Letter to Lisa Jones, EPA, concerning analytical issues associated with the listing constituents for the U and P wastes codes.

Aldrich catalog handbook of fire chemicals. 1988-1989.

APHA, AWWA, and WPCF. 1985. American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Standard method for the examination of water and wastewater. 16th ed. Washington, D.C.: American Public Health Association.

Baldwin. 1989. U.S. Army's installation restoration incineration program is in full swing. Hazardous Materials Technical Center. Vol. 8, No. 4. July 1989.

Belfort, G. 1981. Selective adsorption of organic homologs or to activated carbon from dilute aqueous solutions - solvophobic interaction approach: development and test of theory. Vol. 2. In Chemistry in water reuse, ed. W.R. Cooper, pp. 207-242. Ann Arbor, Mich.: Ann Arbor Science.

Bell, B.J., Inco. 1989. Letter to Ed Rissman, Versar Inc. concerning nickel carbonyl-properties and standard handling procedures.

Casta, J.F. 1962. Chemistry problems. New York: Holt, Rinehart, and Winston.

Claussen, E., EPA. Letter to EPA Solid Waste Branch Chiefs, Regions I-X concerning interim thresholds for toxic gas generation reactivity.

CWM. 1987. Chemical Waste Management. Technical note 87-117, Stabilization treatment of selected metal containing wastes. September 22, 1987. Chemical Waste Management, 150 West 137th Street, Riverdale, IL.

Dean, J.A., ed. 1979. Lange's handbook of chemistry. 12th ed. pp. 3-126 - 3-128. New York: McGraw Hill Book Co.

Department of the Army. 1984. Department of the Army technical manual on military explosives. Washington, D.C.: Headquarters Department of the Army.

Department of the Army. 1987. United States Army Environmental Hygiene Agency. RCRA Part B permit writer's guidance manual for Department of Defense open burning/open detonation units. Aberdeen Proving Ground, Maryland.

Table 5-1 (continued)

BDAT TREATMENT STANDARDS FOR P073
[Nonwastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/kg)
Nichel	0.32

BDAT STANDARDS FOR P073
[Wastewater]

Regulated constituent	Maximum for any single grab sample Total composition (mg/l)
Nickel	0.44

Table 5-1 (continued)

BDAT TREATMENT STANDARDS FOR P056
[Nonwastewaters]

ADSORPTION (ADGAS) FOLLOWED BY NEUTRALIZATION (NEUTR)
AS A METHOD OF TREATMENT*

BDAT TREATMENT STANDARDS FOR U134
[Nonwastewaters]

NEUTRALIZATION (NEUTR) OR ADSORPTION (ADGAS) FOLLOWED
BY NEUTRALIZATION (NEUTR)
AS METHODS OF TREATMENT*

BDAT TREATMENT STANDARDS FOR
P056 AND U134
[Wastewaters]

Regulated constituent	Maximum for any single grab sample Total composition (mg/l)
Fluoride	35

BDAT TREATMENT STANDARDS FOR
P015 AND P087
[Nonwastewaters and Wastewaters]

RECOVERY (RMETL OR RTHRM) AS A METHOD OF TREATMENT*

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* See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

Table 5-1 BDAT Treatment Standards for P and U Wastes Containing Reactive Listing Constituents

BDAT TREATMENT STANDARDS FOR P009, P068, P081, P105, P112, U023, U086, U096, U098, U099, U103, U109, U133, AND U160
[Nonwastewaters]

INCINERATION (INCIN), FUEL SUBSTITUTION (FSUBS), CHEMICAL OXIDATION (CHOXD), OR CHEMICAL REDUCTION (CHRED) AS METHODS OF TREATMENT*

BDAT TREATMENT STANDARDS FOR P009, P068, P081, P112, U023, U086, U096, U098, U099, U103, U109, U133, AND U160
[Wastewaters]

INCINERATION (INCIN), CHEMICAL OXIDATION (CHOXD), CHEMICAL REDUCTION (CHRED), CARBON ADSORPTION (CARBN), OR BIODEGRADATION (BIODG) AS METHODS OF TREATMENT*

BDAT TREATMENT STANDARDS FOR P006, P096, P122, U135, and U249
[Nonwastewaters and Wastewaters]

INCINERATION (INCIN), CHEMICAL OXIDATION (CHOXD), OR CHEMICAL REDUCTION (CHRED) AS METHODS OF TREATMENT* wastewaters treated contained between 4 and 100,310 ppm of nickel. Therefore, the Agency believes that these data are applicable to P073 wastewaters. Based on these data, the Agency is promulgating a concentration-based standard of 0.44 mg/l nickel for P073 wastewaters. A summary of the chemical oxidation performance data used is presented in Appendix K.

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* Incinerators must comply with 40 CFR 264 Subpart O or 265 Subpart O. Fuel substitution units must comply with 40 CFR Part 266 Subpart D. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

Based on the information reviewed for P015 and P087 wastes (as previously described in the nonwastewater section), the Agency is promulgating a treatment standard of "Recovery (RMETL or RTMRM) as a Method of Treatment" for P015 and P087 wastewaters. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

P073, the Agency has decided to develop a concentration-based standard. The performance data used were from the stabilization of F006 nonwastewaters. These F006 wastes contained high concentrations of nickel (as high as 170,000 ppm). Therefore, the Agency believes that these data are applicable to P073 nonwastewaters. Based on these data, the Agency is promulgating a concentration-based standard of 0.32 mg/l nickel for P073 nonwastewaters. A summary of the stabilization performance data used is presented in Appendix J.

For P015 and P087, recovery was the only demonstrated technology identified. The Agency reviewed information from a producer of beryllium and beryllium-containing products indicating that although only very small quantities of P015 are generated at any one time, recovery is a viable and preferred treatment method in light of the high economic value of the recovered beryllium. Additionally, the Agency is aware that it is current practice to recover osmium from P087 using bench-scale technologies because of the high economic value of the recovered osmium. Consequently, the Agency is promulgating a treatment standard of "Recovery (REMETL or RTHRM) as a Method of Treatment" for P015 and P087 nonwastewaters. See 40 CFR 268.42, Table 1, for a detailed description of the technologies referred to by five-letter technology codes in parentheses.

Wastewaters. The Agency identified recovery and chemical oxidation as the only demonstrated treatment of wastewaters containing P073 wastes. These technologies are commercially available and were therefore considered "best."

Based on the information received for P073 wastes (as previously described in the nonwastewater section), the Agency has decided to develop a concentration-based standard for P073 wastewaters. This standard is based on the chemical oxidation of K062 wastewaters. The

Based on the information described above, the Agency is promulgating a concentration-based wastewater treatment standard of 35 mg/l for fluoride in P056 and U134 wastewaters.

5.5.4 BDAT for Recoverable Metallics

All the wastes in this group contain metallic elements (i.e., beryllium, osmium, and nickel) that can be recovered because of their high economic value. Information available to the Agency indicates that recovery of these metallic elements from these wastes is feasible and is currently practiced.

P015 - Beryllium dust
P073 - Nickel carbonyl
P087 - Osmium tetroxide

__Nonwastewaters__. The Agency reviewed information indicating that it is inappropriate to establish recovery as the only acceptable treatment method for nickel carbonyl (P073). Because of the highly reactive nature of the chemical and the fact that it is generated in small quantities, long-term storage to obtain quantities sufficient to justify recovery either on-site or off-site would present a significant safety hazard. The information indicates that P073 can be treated by oxidation, either thermally in an incinerator or chemically in a laboratory-scale treatment facility, followed by stabilization. This is the only safe, economical, and environmentally sound treatment method for small quantities of nickel carbonyl.

Based on this information, the Agency believes that it is not always practical to recover small quantities of nickel and that oxidation of wastewaters followed by stabilization of nonwastewaters will provide effective treatment for P073 wastes. Since EPA has performance data on the stabilization of nickel in nonwastewaters believed to be similar to

Nonwastewaters. Both of these wastes can exist as gases and gases solubilized in wastewaters (although U134 is often generated as an aqueous acid). In the gaseous form, alkaline scrubbing to achieve neutralization has been demonstrated to treat P056 and U134, although recycling and recovery can be used when applicable for some containerized gases.

EPA is promulgating "Adsorption (ADGAS) Followed by Neutralization (NEUTR) as a Method of Treatment" for P056 nonwastewaters and "Neutralization (NEUTR) or Adsorption (ADGAS) followed by Neutralization (NEUTR) as Methods of Treatment" for U134 nonwastewaters since this waste can exist as an acidic solution or a gas. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses. The Agency made this decision as a result of information indicating that most facilities are currently treating gaseous forms of P056 and U134 by reacting the gases with alkaline solution and that it is common practice to neutralize waste hydrofluoric acid (U134).

The Agency has information indicating that these fluorine compounds are mixed with other wastes requiring incineration and that they can be safely incinerated. The Agency is not precluding incineration as long as the acid off-gases are scrubbed with alkaline reagents to achieve the appropriate treatment standard. In this case, the water will act as the adsorbent and the alkaline reagents will neutralize the acidity.

Wastewaters. The Agency has reviewed data applicable for the wastewater forms of P056 and U134 wastes. These data were used to develop numerical treatment standards for BDAT list constituents, such as fluoride. Detailed information on the development of these treatment standards is included in the Best Demonstrated Available Technology (BDAT) Background Document for Wastewaters Containing BDAT List Constituents (EPA 1989e). A summary of the information used to develop the fluoride treatment standard is included in Appendix I.

or Chemical Reduction (CHRED) as Methods of Treatment" for P006, P096, P122, U135, U189, and U249 nonwastewaters. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

Wastewaters. The Agency reviewed information indicating that these wastewaters can be effectively treated by incineration or chemical oxidation/reduction. The Agency believes that both incineration and chemical oxidation/reduction provide substantial treatment and are also commercially available; hence, they are "best."

Based on available information, the Agency is promulgating a treatment standard of "Incineration (INCIN), Chemical Oxidation (CHOXD), or Chemical Reduction (CHRED) as Methods of Treatment" for the wastewater forms of P006, P096, P122, U135, U189, and U249 wastewaters. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

The Agency is currently unaware of any alternative treatment or recycling technologies that have been examined specifically for the nonwastewater or wastewater forms of these P and U wastes. The Agency solicited data and comments on this, but received no response on this issue. The final rule, in any case, does not preclude recycling (provided the recycling does not involve burning as fuel or is not a use constituting disposal, see 40 CFR 261.33).

5.5.3 BDAT for Fluorine Compounds

The following constituents were grouped together because of their physical form and because they contain fluorine:

P056 - Fluorine
U134 - Hydrofluoric Acid

in treatment residues. In cases when there is no analytical method for a particular waste, EPA tries to find an appropriate measurable surrogate or indicator compound; however, no constituent has been identified in these wastes that could be used as a surrogate or indicator compound.

One of the specific problems encountered in analysis of P006 is that this waste breaks down quickly in water (hydrolyzes), making the analysis of wastewater forms of this waste very difficult. In addition, an SW-846 analytical method does not exist for U189.

Nonwastewaters. The Agency has information indicating that incineration and chemical oxidation/reduction can be used for effective treatment for phosphine gas (P096) and hydrogen sulfide gas (U135). The information indicates that both of these gases can be treated by controlled reaction with an aqueous solution of potassium permanganate. This treatment allows the margin of safety that venting into an incinerator does not, since both gases, when heated, emit highly toxic oxides of either sulfur or phosphorus.

The Agency still believes that incineration can be used to effectively and safely treat some of these wastes. However, because many of these wastes will contain high concentrations of sulfur and phosphorus when discarded as off-spec products, they will require as part of their treatment the use of air pollution control equipment capable of controlling the emissions of phosphorus and sulfur to acceptable levels.

The Agency believes that both incineration and chemical oxidation/reduction have been proven to provide substantial treatment. These technologies are also commercially available; hence they are "best."

Based on available information, the Agency is promulgating a treatment standard of "Incineration (INCIN), Chemical Oxidation (CHOXD), in the wastewater forms of these P and U wastes. These technologies are demonstrated, available, and provide substantial treatment; they are therefore considered "best" for some wastes in this group.

Based on the information described above, the Agency is promulgating a treatment standard of "Incineration (INCIN), Chemical Oxidation (CHOXD), Chemical Reduction (CHRED) or Carbon Adsorption (CARBN), or Biodegradation (BIODG) as Methods of Treatment" for the wastewater forms of these P and U wastes. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five-letter technology code in parentheses.

The Agency is unaware of any alternative treatment or recycling technologies that have been examined specifically for these U and P wastes. The Agency solicited data and comments on such technologies but received no response on this issue. In any case, the treatment standards for the nonwastewater and wastewater forms of these P and U wastes does not preclude recycling (provided the recycling is not a use constituting disposal).

5.5.2 BDAT for Incinerable Inorganics

The following constituents have been grouped together because they consist of compounds containing sulfur, nitrogen, and phosphorus:

P006 - Aluminum phosphide
P096 - Phosphine
P122 - Zinc phosphide (>10%)
U135 - Hydrogen sulfide
U189 - Phosphorus sulfide
U249 - Zinc phosphide (<10%)

The Agency does not believe that numerical treatment standards can be established for these wastes at this time. The major problem in establishing concentration-based standards for these wastes is that EPA does not currently have an analytical method for measuring these wastes these highly reactive chemicals; therefore, treatment without dissolving may be preferable. EPA is not precluding the dissolution of these chemicals to facilitate treatment. In cases where there is a significant volume of these chemicals, dissolution may be necessary to reduce air emissions or to reduce the risk of explosion prior to treatment.

Since the analytical problems previously described preclude setting concentration-based treatment standards and RCRA section 3004(m) allows the Agency to establish either levels or methods of treatment, the Agency is promulgating a treatment standard of "Incineration (INCIN), Fuel Substitution (FSUBS), Chemical Oxidation (CHOXD), or Chemical Reduction (CHRED) as Methods of Treatment" for the nonwastewater forms of these U and P wastes. See 40 CFR 268.42, Table 1, for a description of the technologies referred to by a five letter technology code in parentheses.

Although there is an SW-846 method for U109, the Agency is not promulgating a numerical standard for this waste since it is very similar to P068, U086, U098, U099, and U133 (all are hydrazine compounds). Further, there are no performance data from which to establish numerical standards, and it is the Agency's belief that the thermal and chemical destruction technologies specified will provide effective treatment for this waste.

Wastewaters. The Agency determined that carbon adsorption was demonstrated, available, and provided substantial treatment; it was therefore considered "best." Additionally, for wastewaters containing high concentrations of constituents, incineration was determined to be demonstrated, available, and therefore "best."

Data reviewed by the Agency indicate that some of these wastes (i.e., P068) can be effectively treated by ozone/ultraviolet light oxidation (chemical oxidation). EPA also has information indicating that biodegradation is capable of destroying the reactive organic constituents hydrolysis products would have on the environment. Also, verified analytical methods do not currently exist for the quantification of these hydrolysis products in treatment residues.

Another analytical problem is created because P081 wastes are only quantifiable by High Performance Liquid Chromatography (HPLC) methods. Although HPLC techniques have been used to quantify certain chemicals in relatively clean aqueous matrices, the Agency has not completely verified that HPLC is appropriate for analysis of either untreated wastes or treatment residuals. There is only one HPLC method currently listed in SW-846 as applicable for analysis of solid wastes, with very limited applicability. However, the Agency is in the process of validating other HPLC methods, including multiple-column HPLC systems and HPLC units coupled with mass spectroscopy. Until this method validation work is completed, the Agency does not believe that it should establish concentration-based treatment standards for these particular U and P chemicals. Further, the Agency currently lacks data on treatment of hazardous wastes based on HPLC analyses. In addition, there are no verified SW-846 analytical methods for measuring P009 and U133 in treatment residues.

Nonwastewaters. The Agency has identified incineration, fuel substitution, and chemical oxidation/reduction as demonstrated technologies for treatment of reactive organic constituents. These technologies are considered commercially available and provided substantial treatment of reactive organic constituents; therefore, they are considered "best."

Many of the U and P wastes exist as concentrated off-specification chemicals. Depending on other constituents present in the waste matrix, these off-specification chemicals could potentially be dissolved in a suitable waste solvent prior to treatment (i.e., incinerated in a liquid injection system). There is, however, risk associated with dissolving

Compounds, and Recoverable Metallics. The discussion of the treatment standards applicable to each subgroup follows. Table 5-1 at the end of this section summarizes the treatment standards for P and U wastes containing reactive listing constituents.

5.5.1 BDAT for Incinerable Reactive Organics and Hydrazine Derivatives

The following constituents have been grouped together because they are organic constituents that can be incinerated:

P009 - Ammonium picrate
P081 - Nitroglycerine
P112 - Tetranitromethane
U023 - Benzotrichloride
U096 - a,a-Dimethylbenzylhydroperoxide
U103 - Dimethyl sulfate
U160 - Methyl ethyl ketone peroxide
P068 - Methyl hydrazine
P105 - Sodium azide
U086 - 1,2-Diethylhydrazine
U098 - 1,1-Dimethylhydrazine
U099 - 1,2-Dimethylhydrazine
U109 - 1,2-Diphenylhydrazine
U133 - Hydrazine

The Agency does not believe that concentration-based treatment standards can be established for these wastes at this time. The major problems in establishing concentration-based standards for these wastes are (1) EPA does not currently have an analytical method for measuring many of these wastes in treatment residues and (2) where the Agency does have methods, there are no data available on the treatment of these chemicals. In cases when there is no verified analytical method for a particular waste, EPA tries to find an appropriate measurable surrogate or indicator compound. However, no constituent has been identified in these wastes that could be used as a surrogate or indicator compound.

One of the specific problems encountered in analysis of P068, P105, P112, U023, U098, U099, and U103 is that these wastes break down quickly in water (hydrolyze) and the analysis of wastewater forms of these wastes is very difficult, as well as often hazardous because of the intensity of the reaction. In addition, the Agency lacks data on what effects the to treat U160 nonwastewaters. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that these wastewaters can be easily adsorbed because of their polar nature. Therefore, the Agency considers carbon adsorption to be demonstrated for these wastewaters.

U189 - Phosphorus sulfide - EPA has found one commercial facility using incineration for treatment of U189 nonwastewaters; hence, incineration is demonstrated. This compound reacts with water, and consequently it is believed that wastewater forms cannot exist.

U249 - Zinc phosphide (<10%) - EPA has found one commercial facility using incineration for treatment of U249 nonwastewaters; hence, incineration is demonstrated. Since this constituent is water reactive, it is believed that wastewater forms cannot exist; however, the dissociated zinc can be precipitated with lime.

5.5 Identification of Best Demonstrated Available Technology (BDAT)

This section presents the rationale for determination of best demonstrated available technology (BDAT) for each reactive P and U waste. First, the Agency examines all the demonstrated technologies to determine whether one of the technologies performs significantly better than another. Next, the "best" performing treatment technology is evaluated to determine whether the resulting treatment is "substantial." Since EPA does not have performance data for any of these wastes and because of the lack of analytical methods, the Agency's evaluation of "substantial" is based on the performance of technologies established in the Agency's BDAT data base. If the "best" technology provides "substantial" treatment and it has been determined that the technology is also commercially available to the affected industry, then the technology represents BDAT.

For the purpose of BDAT determinations, the Agency has identified four subgroups according to similarities in treatment, chemical composition, and structure. These groups are Incinerable Reactive Organics and Hydrazine Derivatives, Incinerable Inorganics, Fluorine these wastewaters can be easily adsorbed because of the branched nature of their structures, their high molecular weights, and their low solubility in water. Therefore, the Agency considers carbon adsorption to be demonstrated for these wastewaters.

U109 - 1,2-Diphenylhydrazine - EPA has found one commercial facility using incineration for treatment of U109 nonwastewaters; therefore, incineration is demonstrated. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that these wastewaters can be easily adsorbed because of their polar nature. Therefore, the Agency considers carbon adsorption to be demonstrated for these wastewaters.

U133 - Hydrazine - EPA has found one commercial facility using incineration for treatment of U133 nonwastewaters; therefore, incineration is demonstrated. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that these wastewaters can be easily adsorbed because of their polar nature. Therefore, the Agency considers carbon adsorption to be demonstrated for these wastewaters.

U134 - Hydrogen fluoride - The disposal of hydrogen fluoride is similar to the disposal of fluorine. In fact, the same scrubbing equipment and the same alkaline scrubbing solutions are used by two facilities for both waste fluorine and waste hydrogen fluoride. Two other facilities utilize scrubbing, or a variation of scrubbing, for their waste hydrogen fluoride gas but do not scrub fluorine. A fifth vendor uses recovery and recycle techniques on its gas cylinders, but its situation is special because its locations deal only in 850-pound, 1-ton, and 20-ton containers. With such large containers, recovery and recycle are the most technically feasible practice. Because four companies use alkaline scrubbing and one uses product recovery and recycle, these are demonstrated technologies.

U135 - Hydrogen sulfide - It is common practice to incinerate hydrogen sulfide, which will generate sulfur dioxide off-gas. The off-gas can be scrubbed with alkaline solution to generate calcium sulfate. Hence, the Agency believes that incineration is demonstrated to treat hydrogen sulfide gas and that chemical oxidation of any sulfide to sulfate, followed by precipitation, is demonstrated to treat U135 wastewaters.

U160 - Methyl ethyl ketone peroxide - One facility reportedly uses thermal destruction to treat U160 nonwastewaters. EPA has also found one commercial facility using incineration for treatment of U160 nonwastewaters; therefore, both technologies are demonstrated

U023 - Benzotrichloride - EPA has found one commercial facility using incineration for treatment of U023 nonwastewaters and consequently believes that incineration is demonstrated. Since this compound reacts with water, it is believed that wastewater forms cannot exist; however, carbon absorption has been demonstrated to treat benzoic acid, which is one of the products formed by the reaction of benzotrichloride with water.

U086 - N,N-Diethylhydrazine - EPA has found one commercial facility using incineration for treatment of U086 nonwastewaters and consequently believes that incineration is demonstrated. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that U086 wastewaters can be easily adsorbed because of the branched nature of their structures, the high molecular weights, and their low solubility in water. Therefore, the Agency believes carbon adsorption to be demonstrated for these wastewaters.

U096 - a,a-Dimethylbenzylhydroperoxide - EPA has found one commercial facility using incineration for treatment of U096 nonwastewaters; hence, incineration is demonstrated. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that these wastewaters can be easily adsorbed because of the branched nature of their structures, their high molecular weights, and their low solubility in water. Therefore, the Agency considers carbon adsorption to be demonstrated for these wastewaters.

U098 - 1,1-Dimethylhydrazine - EPA has found one commercial facility using incineration for treatment of U098 nonwastewaters; therefore, incineration is demonstrated. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that these wastewaters can be easily adsorbed because of their polar nature. Therefore, the Agency considers carbon adsorption to be demonstrated for these wastewaters.

U099 - 1,2-Dimethylhydrazine - EPA has found one commercial facility using incineration for treatment of U099 nonwastewaters; therefore, incineration is demonstrated. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that these wastewaters can be easily adsorbed because of the branched nature of their structures, the high molecular weights, and their low solubility in water. Therefore, the Agency considers carbon adsorption to be demonstrated for these wastewaters.

U103 - Dimethyl sulfate - EPA has found one commercial facility using incineration for treatment of U103 nonwastewaters; therefore, incineration is demonstrated. Carbon adsorption has been demonstrated on similar wastewaters. The Agency believes that

P087 - Osmium tetroxide - EPA has found one facility that bench-treated an aqueous solution of osmium tetroxide with potassium iodide to precipitate the osmium metal. The metal was recovered and sent to a producer of osmium chemicals. (Since osmium is presently valued at $1,350 per ounce, it is unlikely that anyone is discarding the material.) According to the 1986 Minerals Yearbook, only 2 pounds of osmium tetroxide were produced; therefore, the Agency believes it appropriate to use bench-scale performance data. Hence, recovery is a demonstrated technology for wastewater forms. Similar nonwastewaters have been slurried and treated as stated above; therefore, the Agency believes precipitation followed by recovery of the osmium to be demonstrated for nonwastewater forms of P087.

P096 - Phosphine - The Agency believes that it is common practice to incinerate phosphine to phosphorus pentoxide and scrub the off-gas with lime solution to generate calcium phosphate. This scrubber water can be treated with neutralization. Hence, the Agency considers incineration to be demonstrated to treat phosphine gas and chemical oxidation followed by precipitation to be demonstrated to treat P096 wastewaters.

P105 - Sodium azide - EPA has found one facility using incineration for treatment of P105 nonwastewaters; therefore, the Agency has concluded that incineration is demonstrated for nonwastewaters. Nitrite treatment can be accomplished by adding sodium nitrite to sodium azide to produce nitrogen and sodium hydroxide. This treatment is currently used by a facility for treatment of lead azide. Lead azide is believed to be a similar waste based on chemical properties; consequently, the Agency considers chemical oxidation to be demonstrated to treat P105 wastewaters.

P112 - Tetranitromethane - EPA has found one commercial facility incinerating dilute concentrations of P112. This facility claims that the waste is sufficiently stable when blended with other wastes to form a dilute mixture that can be incinerated. Hence, incineration is demonstrated to treat P112 wastewaters and nonwastewaters. Additionally, carbon adsorption has been demonstrated for similar wastewaters containing explosive nitro groups (i.e., the listed waste K045 is spent carbon for treatment of wastewaters from the production of nitrate esters and other nitrated explosives). Consequently, the Agency considers carbon adsorption to be demonstrated to treat P112 wastewaters.

P122 - Zinc phosphide (>10%) - EPA has found one commercial facility using incineration for treatment of P122 nonwastewaters and consequently believes that incineration is demonstrated. Since this compound reacts with water, it is believed that wastewater forms cannot exist; however, the dissociated zinc can be precipitated with lime.

P068 - Methyl hydrazine - EPA has found one commercial facility presently incinerating P068 nonwastewaters on a full-scale basis. Therefore, the Agency believes incineration to be demonstrated. The Agency has found one facility (NASA 1989) using an ozone/ultraviolet light oxidation treatment system for destruction of methyl hydrazines in a dilute aqueous solution (<100 ppm methyl hydrazine). The facility uses total organic carbon (TOC) and some intermediate products to monitor and evaluate the system; therefore, the Agency believes ozone/ultraviolet light to be demonstrated for the dilute wastewater forms of P068. However, the Agency believes that the oxidation process should be followed with carbon adsorption as a polishing step for removal because the oxidation treatment has been demonstrated only for dilute wastewaters. Carbon adsorption has been demonstrated on similar wastes. The Agency believes that these wastewaters can be easily adsorbed because of the branched nature of their structures, their large molecular weights, and their low solubility in water. Therefore, EPA believes carbon adsorption is demonstrated for P068 wastewaters. Following adsorption, the resulting nonwastewater carbon residual must be incinerated.

P073 - Nickel carbonyl - EPA contacted a nickel smelter that uses the Mond process to purify nickel (Bell 1989). During the Mond process, nickel carbonyl is passed through a heated bed of alumina at 200°C to recover nickel. The heat and alumina catalyst cause the nickel carbonyl to decompose into nickel and carbon dioxide. The carbon dioxide is fed to an incinerator and destroyed. EPA believes that for wastewater and nonwastewater forms of P073, nickel recovery using the Mond process is demonstrated. EPA has information indicating that chemical oxidation followed by stabilization is currently being used for P073 wastes; therefore, this treatment is also demonstrated.

P081 - Nitroglycerin - The Agency has found one facility using thermal destruction for treatment of nonwastewater forms of a nitroglycerin waste. EPA has determined that one facility is using rotary kiln incineration for treatment of nitroglycerin wastewaters and nonwastewater slurries. EPA believes that thermal destruction and incineration are demonstrated for nonwastewaters and that incineration is demonstrated for wastewaters. Additionally, carbon adsorption has been demonstrated for similar wastewaters containing explosive nitro groups (i.e., the listed waste K045 is spent carbon for treatment of wastewaters from the production of nitrate esters and other nitrated explosives). Consequently, the Agency believes that carbon adsorption, as well as incineration, is demonstrated to treat P081 wastewaters.

Since this compound is water reactive, it is believed that wastewater forms cannot exist; however, phosphine, one of the products of decomposition, can be oxidized and precipitated with lime to form calcium phosphate.

P009 - Ammonium picrate - EPA could find no producers of this chemical listed in the SRI 1988 edition and no generators of the waste listed in the 1986 TSDR Survey. EPA believes that thermal destruction (i.e. incineration in specially designed units) is the best treatment for this waste. EPA believes that thermal destruction has been demonstrated to treat similar wastes; therefore, the Agency believes thermal destruction is demonstrated to treat P009 wastewaters and nonwastewaters. Additionally, carbon adsorption has been demonstrated for similar wastewaters containing explosive nitro groups (i.e., the listed waste K045 is spent carbon from treatment of wastewaters from the production of nitrate esters and other nitrated explosives). Consequently, the Agency believes carbon adsorption is demonstrated to treat P009 wastewaters.

P015 - Beryllium dust - The Agency has identified a metallic beryllium producer that accepts beryllium wastes including P015 for recycling. The wastes are manifested directly to the facility since it has a RCRA storage permit. The facility usually only accepts beryllium wastes that are not highly contaminated. The wastes generally go through several proprietary processes to remove some of the contaminants (such as iron and lead); the waste is then added to the production process to make metallic beryllium. Additionally, for highly contaminated wastes, the facility has a vacuum cleaning process to recover beryllium from the dust. Hence, EPA believes that recovery is demonstrated to treat P015.

P056 - Fluorine - Two companies (in Pennsylvania and New Jersey) use alkaline scrubbers to react with waste fluorine gas, although each uses a different alkaline agent. One company uses potassium hydroxide solution and then ships the spent solution to a commercial wastewater treatment plant for disposal. The other company uses a caustic soda (sodium hydroxide) solution in its scrubber, and when the resulting sodium fluoride concentration exceeds its solubility concentration (about 4.0 g/100 ml of water), the sodium fluoride is filtered out, drummed, and then shipped to a permitted disposer. Hence, solubilization in alkaline water is demonstrated to treat gaseous forms of P056. The Agency has also identified one facility using precipitation of fluoride as calcium fluoride (USEPA 1988f). Precipitation is demonstrated to treat P056 wastewaters.

Nonwastewaters. EPA has identified incineration as applicable for nonwastewaters and gases with inorganic reactive constituents other than metals. Incineration is a technology that can destroy oxidizable inorganics. Gases can be vented directly into the incinerator. It should be mentioned that off-gases generated during the incineration of these wastes may require an afterburner and/or may need to be scrubbed before release to the atmosphere.

Gases that cannot be combusted should be solubilized in water. The resulting compound present in aqueous scrubber solution should be precipitated as an insoluble innocuous compound.

Wastewaters. The technologies identified as applicable for P and U wastewaters containing reactive listing constituents are chemical oxidation/reduction methods (e.g., alkaline chlorination) followed by precipitation.

5.4.2 Demonstrated Treatment Technologies

EPA considers demonstrated technologies to be those that are used on a full-scale basis to treat the waste of interest or a similar waste with regard to parameters that affect treatment selection. To determine what treatment technologies are "demonstrated" for the reactive P and U codes, the Agency contacted both generators and treaters of the wastes (Rissmann 1989). The following are summaries for each investigation concerning the demonstrated treatment technologies for the individual reactive P and U wastes.

P006 - Aluminum phosphide - EPA contacted the only generator listed in the 1986 TSDR Survey to gather information about treatment. This company is also the only known producer; however, the company claims that it no longer produces aluminum phosphide. The Agency believes zinc phosphide (P122) to be a similar waste based on physical and chemical characteristics. Incineration is demonstrated to treat P122. Consequently, the Agency believes incineration to be demonstrated to treat P006 nonwastewaters.

solubilities have also been successfully treated using carbon adsorption. Illustrations supporting this argument are presented in Appendix H.

(2) Applicable treatment technologies for metal constituents. The technologies considered applicable to treating P and U wastes containing reactive metal constituents are those that remove the reactive characteristic and/or recover the metals.

Nonwastewaters. For the metals present in nonwastewater P and U wastes, potentially applicable treatment technologies are stabilization and high-temperature metals recovery. Stabilization immobilizes the metal constituents to minimize leaching. High-temperature metals recovery provides for recovery of metals from wastes primarily by volatilization of some of the metals, subsequent condensation, and collection. The process yields a metal product for reuse and reduces the amount of waste that needs to be land disposed. Additionally, most metallic nonwastewaters can be slurried such that metals can be recovered or treated using wastewater treatment techniques.

Wastewaters. The technologies applicable for reactive constituents present in a wastewater matrix are chemical precipitation and removal of the precipitated metal solids using settling or sludge filtration. Chemical precipitation removes dissolved metals from solution, and settling/sludge filtration removes suspended solids.

(3) Applicable treatment technologies for inorganics other than metals. The technologies identified as potentially applicable are those that destroy the compound or render it less harmful by removing the reactive characteristic.

consist of ash and scrubber water. Incineration of highly explosive constituents may require treatment in units that are specially designed and fitted with certain explosion-proof equipment. These types of units are not typically found at commercial incineration facilities. The Agency is aware that these types of units are currently used for many of the Department of Defense explosive wastes. Fuel substitution, like incineration, destroys organic constituents in a waste. Since many of these wastes have high Btu values (e.g., hydrazine is used in rocket fuel), EPA believes that they are excellent candidates for fuel substitution. Additionally, the Agency has determined that these wastes can be chemically deactivated using chemical oxidation and chemical reduction technologies.

Wastewaters. The Agency has identified carbon adsorption followed by regeneration or incineration of the spent carbon, wet air oxidation, biological treatment, and solvent extraction as potentially applicable for treatment of hazardous P and U reactive organic constituents in wastewaters. Additionally, incineration has been identified for wastewaters containing high levels of reactive compounds that may become increasingly dangerous when concentrated on carbon or in an extraction fluid.

These applicable technologies destroy or reduce the total concentration of hazardous organic compounds in the waste (incineration, wet air oxidation, and biological treatment) or selectively remove hazardous organic compounds from the waste stream (carbon adsorption and solvent extraction). The Agency believes that not all P and U wastes contain reactive listing constituents amenable to treatment with biological, wet air oxidation, and solvent extraction methods. However, most of these wastewaters are somewhat amenable to carbon adsorption because the constituents typically have low solubility in water, have high molecular weights, and have branched, rather than straight chain, molecular structures. Compounds with lower molecular weights and higher

5.4.1 Applicable Treatment Technologies

Because the Agency has no waste characterization data specifically for the reactive P and U wastes, the applicable technologies are based on the characteristics described in Section 4.1 for the reactive listing constituents.

The following subsections present applicable treatment technologies for the (1) organic constituents, (2) metal constituents, and (3) inorganic constituents other than metals in nonwastewater and wastewater forms of the P and U wastes containing reactive constituents. For the purpose of the land disposal restrictions rule, wastewaters are defined as wastes containing less than 1 percent (weight basis) total suspended solids and less than 1 percent (weight basis) total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters. For a more detailed discussion of each treatment technology, see the Treatment Technology Background Document (USEPA 1989a).

(1) **Applicable treatment technologies for organic constituents**. For wastes containing reactive organic constituents, the technologies considered applicable are those that destroy the organics in a manner that is safe to human health and the environment.

Nonwastewaters. The technologies that the Agency has identified as applicable for treatment of nonwastewaters containing reactive organic constituents are incineration, fuel substitution, and chemical oxidation/ reduction.

Incineration is a technology that destroys the organic constituents in the waste by converting them to carbon dioxide, water, and other combustion products. Incineration may result in residuals that require treatment because of their metal content. Specifically, the residuals